श्री Davara University

Established under Chhattisgarh Private Universities (Establishment and Operation) Act, 2005

Shri Davara University, Raipur

Curriculum

Master of Science in Mathematics

Semester-I

(Effective from Session: 2024-25)

Programme Code – FOSMSC2MAT

श्री Davara University

Established under Chhattisgarh Private Universities (Establishment and Operation) Act, 2005

TWO YEAR POSTGRADUATE PROGRAMME
MASTER OF SCIENCE IN MATHEMATICS
COURSE STRUCTURE

Semester-I

S. No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Sem End Exam	Continuous Evaluation	Total	
1	DUMSC101	Advanced Abstract Algebra-I	4	1	-	5	70	30	100	3
2	DUMSC102	Real Analysis-I	4	1	-	5	70	30	100	3
3	DUMSC103	Topology	4	1	-	5	70	30	100	3
4	DUMSC104	Complex Analysis-I	4	1	-	5	70	30	100	3
5	DUMSC105	Advanced Discrete Mathematics-I	4	1	-	5	70	30	100	3
Total			**20**	**5**	**-**	**25**			**500**	**15**

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Advanced Abstract Algebra-I**				
Code	**DUMSC101**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	Knowledge of series.				
Objective	Advanced Abstract Algebra is a **foundational tool** for understanding and solving a broad range of problems in mathematics, science, engineering, and beyond. Whether you are working in **pure mathematics**, **applied fields**, or even **cryptography**, the concepts and techniques from abstract algebra provide a **unified and powerful** framework that underpins much of modern theory and application. By studying advanced algebra, you learn to **think critically**, **reason abstractly**, and **apply general principles** to a wide variety of challenges.				
Content	**Unit 1** Groups - Normal and Subnormal series. Composition series. Jordan-Holder theorem. Solvable groups. Nilpotent groups. **Unit 2** Field theory- Extension fields. Algebraic and transcendental extensions. Separable and inseparable extensions. Normal extensions. **Unit 3** Perfect fields. Finite fields. Primitive elements. Algebraically closed fields. **Unit 4** Automorphisms of extensions. Galois extensions. Fundamental theorem of Galois theory. **Unit 5** Solution of polynomial equations by radicals. Insolvability of the general equation of degree 5 by radicals.				
Outcome	On the successful completion of this course student will be able to develop Mathematical Concept of the social and natural problems by logic facts. Algebra helps to present the problems logically for the logical solution. Students understood the concept of Groups, Fields, solution of polynomial equation and its applications in real life.				
Text Book	**Text Book :** 1. P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul: Basic Abstract Algebra, Cambridge University press 2. I.N.Herstein: Topics in Albegra, Wiley Eastern Ltd. 3. Vivek Sahai and Vikas Bist: Algebra, Narosa Publishing House, 1999.				

Reference Books	**References Books:** 1. M.Artin, Algeabra, Prentice -Hall of India, 1991. 2. P.M. Cohn, Algebra,Vols.I,II&III, John Wiley & Sons, 1982,1989,1991. 3. N.Jacobson, Basic Algebra, Vols. I , W.H. Freeman, 1980 (also published by Hindustan Publishing Company). 4. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993. 5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol.II-Rings, Narosa Publishing House (Vol.l-1996,Vol. II-1999) 6. D.S.Malik, J.N.Mordeson, and M.K.Sen, Fundamentals of Abstract Algebra, Mc Graw-Hill, International Edition,1997. 7. QuaziZameeruddin and Surjeet Singh : Modern Algebra 8. I. Stewart, Galois theory, 2nd edition, chapman and Hall, 1989. 9. J.P. Escofier, Galois theory, GTM Vol.204, Springer, 2001.. 10. Fraleigh , A first course in Algebra Algebra, Narosa,1982.

Assessment and Evaluation

Suggested Continuous EvaluationMethods:MaximumMarks:100Marks
Continuous Internal Assessment(CIA) :30Marks
End Semester Exam(ESE): 70Marks

ContinuousInternalAssessment(CIA): 30 (By Course Teacher)	Internal Test/Quiz: 20+20Assignment/ Seminar-10 TotalMarks-30	Better marks out of the two Total Quiz + obtained marks in Assignment shall be considered against 30 Marks

End Semester Exam	**Twosection :**A&B Section A:Q1.Objective10*1=10Marks Q2.Short answer type question -5*4=20 Section B:Descriptive answer type question,1 out of 2 from each unit - 4*10=40Marks

Signature of Members(BoS)

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Real Analysis-I**				
code	**DUMSC102**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	Knowledge of sequences.				
Objective	**Real analysis** serves as the **foundation for much of modern mathematics** and its applications. It is essential for providing a **rigorous understanding** of calculus, refining problem-solving skills, and exploring more advanced topics in analysis, topology, and functional spaces. The logical reasoning and proof techniques learned in real analysis are crucial for many fields, especially in pure mathematics, physics, and engineering, where **precision** and **understanding infinite processes** are key.				
Content	**Unit 1** Sequences and series of functions, pointwise and uniformconvergence, Cauchy criterion for uniform convergence, WeierstrassM-test, Abel's and Dirichlet's tests for uniform convergence, uniformconvergence and continuity, definition and simple properties ofRiemann-Stieltjes integral, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation,Weierstrass approximation theorem. **Unit 2** Power series, uniqueness theorem for power series, Abel's andTauber's theorems. Rearrangements of terms of a series, Riemann'stheorem. **Unit 3** Functions of several variables, linear transformations, Derivatives inan open subset of Rn, Chain rule, Partial derivatives, interchange ofthe order of differentiation, Derivatives of higher orders, Taylor'stheorem, Inverse function theorem, Implicit function theorem. **Unit 4** Jacobians, extremum problems with constraints, Lagrange'smultiplier method, Differentiation of integrals. **Unit 5** Partitions of unity, Differential forms, Stoke's theorem.				
Outcome	On the successful completion of this course student will be able to develop Mathematical Concept of the social and natural problems by logic facts. Real analysis helps to present the problems logically for the logical solution. Students understood the concept of sequence, series, and its applications in real life				

Text Books	**Text Books**: 1. Principle of Mathematical Analysis By Walter Rudin (3rd edition) McGraw-Hill, Kogakusha, 1976, International student edition. 2. Real Analysis By H.L.Roydon, Macmillan Pub.Co.Inc.4th Edition, New York .1962.
References Books	**ReferencesBooks:** 1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985. 2. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975. 3. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968. 4. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981. 5. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969. 6. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000). 7. I.P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick Ungar Publishing Co., 1961. 8. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc.1977. 9. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962. 10. A. Friedman, Foundations of Modern Analysis, Holt, Rinehart and Winston, Inc., New York, 1970.

Assessment and Evaluation

Suggested Continuous EvaluationMethods:MaximumMarks:100Marks
Continuous Internal Assessment(CIA) :30Marks
End Semester Exam(ESE): 70Marks

ContinuousInternalAssessment(CIA): 30 (By Course Teacher)	Internal Test/Quiz: 20+20Assignment/ Seminar-10 TotalMarks-30	Better marks out of the two Total Quiz + obtained marks in Assignment shall be considered against 30 Marks

End SemesterExam	**Twosection :**A&B Section A:Q1.Objective10*1=10Marks Q2.Short answer type question -5*4=20 Section B:Descriptive answer type question,1 out of 2 from each unit - 4*10=40Marks

Signature of Members(BoS)

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Topology**				
Code	**DUMSC103**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	**Knowledge of sets.**				
Objective	Topology is important because it provides a unified framework for understanding the properties of spaces, both in their simplest and most abstract forms. Whether it's classifying shapes, understanding the behavior of functions, or studying the large-scale properties of spaces, topology has profound applications across mathematics, science, and engineering. It is essential for anyone interested in understanding the foundational concepts of space, continuity, and transformation that underpin much of modern mathematics and physics.				
Content	**UNIT – 1** Countable and uncountable sets. Infinite sets and the Axiom ofChoice. Cardinal numbers and its arithmetic. Schroeder-Bernsteintheorem. Cantor's theorem and the continuum hypothesis. Zorn'slemma, well-ordering theorem. Definition and examples oftopological spaces. Closed sets. Closure. Dense subsets.Neighborhoods. Interior, exterior and boundary. Accumulationpoints and derived sets. Bases and sub-bases. Subspaces and relativetopology. **UNIT – 2** Alternate methods of defining a topology in terms of terms ofKuratowski Closure Operator and NeighbourhoodSystems.Continuous functions and homeomorphism. First and SecondCountable spaces. Lindelof's theorems. Separable spaces. Second countability and separability. **UNIT – 3** Separation axioms; their Characterizations and basic properties.Urysohn's lemma, Tietze extension theorem. **UNIT –4** Compactness. Continuous functions and compact sets. Basicproperties of Compactness. Compactness and finite intersectionproperty. Sequentially and countably compact sets. Localcompactness and one point compactification. Stone-Cechcompactification. **UNIT – 5** Compactness in metric spaces. Equivalence of compactness,countable compactness and sequential compactness in metric space.Connected spaces. Connectedness on the real line. Components.Locally connected spaces.				
Outcome	On the successful completion of this course student will be able to develop Mathematical Concept of the social and natural problems by logic facts. Topology helps to present the problems logically for the logical solution. Students understood the concept of Metric spaces, compactness, closed and open sets and its applications in real life				

<table>
<tr><td>Text Books</td><td>Text Books:
1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi,2000.
2. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.</td></tr>
<tr><td>Reference Books</td><td>Reference Books:
1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
2. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
3. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
6. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966.
7. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964.
10. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966.</td></tr>
<tr><td colspan="2">Assessment and Evaluation</td></tr>
<tr><td colspan="2">Suggested Continuous EvaluationMethods:MaximumMarks:100Marks
Continuous Internal Assessment(CIA) :30Marks
End Semester Exam(ESE): 70Marks</td></tr>
<tr><td>ContinuousInternalAssessment(CIA): 30
(By Course Teacher)</td><td>Internal Test/Quiz: 20+20Assignment/ Seminar-10
TotalMarks-30</td><td>Better marks out of the two Total Quiz + obtained marks in Assignment shall be considered against 30 Marks</td></tr>
<tr><td>End SemesterExam</td><td colspan="2">Twosection :A&B
Section A:Q1.Objective10*1=10Marks Q2.Short answer type question -5*4=20
Section B:Descriptive answer type question,1 out of 2 from each unit - 4*10=40Marks</td></tr>
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</table>

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Complex Analysis-I**				
Code	**DUMSC104**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	Knowledge of spaces.				
Objective	**complex analysis** is a vital branch of mathematics that provides tools for solving a wide range of **real-world problems** in **physics**, **engineering**, and **applied mathematics**. It allows us to understand and manipulate functions of complex variables, providing insights into continuity, singularities, and integrals that are not as easily accessible through real analysis alone. The theory of complex functions is deeply connected to other areas of mathematics and physics, making it an indispensable tool in both theoretical and applied disciplines.				
Content	**Unit 1** Complex integration, Cauchy-Goursat. Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouville's theorem. The fundamental theorem ofalgebra. Taylor's theorem. Laurent's series. Isolated singularities. Meromorphic functions. **Unit 2** Maximum modulus principle. Schwarz lemma. The argument principle. Rouche's theorem Inverse function theorem. **Unit 3** Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to arg z, logz and za. **Unit 4** Bilinear transformations, their properties and classifications. Definitions and examples of Conformal mappings. **Unit 5** Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem				
Outcome	On the successful completion of this course student will be able to develop Mathematical Concept of the social and natural problems by logic facts. Complex Analysis helps to present the problems logically for the logical solution. Students understood the concept of Analytic function, residue, Conformal mapping and its applications in real life				
Text Books	**Text Books**: 1. Complex Analysis By L.V.Ahlfors, McGraw - Hill, 1979. 2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House,1980.				

ReferencesBooks	**ReferencesBooks:** **1.** H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990. **2.** Complex Function Theory By D.Sarason **3.** Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996. **4.** S. Lang, Complex Analysis, Addison Wesley, 1977. **5.** D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994. **6.** Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998. **7.** E. Hille, Analytic Function Theory (2 Vols.) Gonn& Co., 1959. **8.** W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.Van Nostrand Co., 1967. **9.** C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964. **10.** M.Heins, Complex Function Theory, Academic Press, 1968

Assessment and Evaluation

Suggested Continuous EvaluationMethods:MaximumMarks:100Marks
Continuous Internal Assessment(CIA) :30Marks
End Semester Exam(ESE): 70Marks

ContinuousInternalAssessment(CIA): 30 (By Course Teacher)	Internal Test/Quiz: 20+20Assignment/ Seminar-10 TotalMarks-30	Better marks out of the two Total Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam	**Twosection :**A&B Section A:Q1.Objective10*1=10Marks Q2.Short answer type question -5*4=20 Section B:Descriptive answer type question,1 out of 2 from each unit - 4*10=40Marks	

Signature of Members(BoS)

TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Advanced Discrete Mathematics-I**				
Code	**DUMSC105**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	Knowledge of logical operator.				
Objective	**Advanced Discrete Mathematics** is an important branch of mathematics that deals with discrete structures rather than continuous ones. It has numerous applications in computer science, cryptography, algorithms, combinatorics, and more.				
Content	**Unit 1** Formal Logic-Statements. Symbolic Representation and Tautologies. Quantifiers, Predicates and Validity. Propositional Logic. Semigroups & Monoids-Definitions and Examples of Semigroups and monoids (including those pertaining to concatenation operation). **Unit 2** Homomorphism of semigroups and monoids. Congruence relation and Quotient Semigroups. Subsemigroup and submonoids. Direct Products. Basic Homomorphism Theorem. **Unit 3** Lattices-Lattices as partially ordered sets. Their properties. Lattices as Algebraic Systems. Sublattices, Direct products, and Homomorphisms. Some Special Lattices e.g., Complete, Complemented and Distributive Lattices. Boolean Algebras-Boolean Algebras as Lattices. Various Boolean Identities. The Switching Algebra example. Subalgebras, **Unit 4** Direct Products and Homomorphisms. Join-Irreducible elements, Atoms and Minterms. Boolean Forms and Their Equivalence. Minterm Boolean Forms, Sum of Products Canonical Forms. Minimization of Boolean Functions. Applications of Boolean Algebra to Switching Theory (using AND,OR& NOT gates). The Karnaugh Map Method. **Unit 5** Grammars and Languages-Phrase-Structure Grammars. Rewriting Rules. Derivations. Sentential Forms. Language generated by a Grammar. Regular, Context-Free, and Context Sensitive Grammars and Languages. Regular sets, Regular Expressions and the Pumping Lemma. Kleene's Theorem. Notions of Syntax Analysis, Polish Notations. Conversion of Infix Expressions to Polish Notations. The Reverse Polish Notation.				
Outcome	On the successful completion of this course student will be able to develop Mathematical Concept of the social and natural problems by logic facts. Advance Discrete Mathematics helps to present the problems logically for the logical solution. Students understood the concept of Logic statements, Grammars, Language, Groups, Lattices and its				

<table>
<tr><td></td><td colspan="3">applications in real life</td></tr>
<tr><td>Text Books</td><td colspan="3">Text Books:
1. Elements of Discrete Mathematics By C.L.Liu
2. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.</td></tr>
<tr><td>References Books</td><td colspan="3">References Books:
1. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
2. Seymour Lepschutz, Finite Mathematics (International) edition (1983), McGraw-Hill Book Company, New York.
3. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co.
4. J.E. Hopcroft and J.D Ullman, Introduction to Automata Theory, Languages & Computation, Narosa Publishing House.
5. C.L Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
6. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. Prentice Hall of India
7. K.L.P.Mishra and N.Chandrashekaran, Theory of Computer SciencePHI(2002)</td></tr>
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Shri Davara University, Raipur

Curriculum

Master of Science in Mathematics

Semester-II

(Effective from Session: 2024-25)

Programme Code – FOSMSC2MAT

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TWO YEAR POSTGRADUATE PROGRAMME
MASTER OF SCIENCE IN MATHEMATICS
COURSE STRUCTURE

Semester-II

S. No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Sem End Exam	Continuous Evaluation	Total	
1	DUMSC201	Advanced Abstract Algebra-II	4	1	-	5	70	30	100	3
2	DUMSC202	Real Analysis-II	4	1	-	5	70	30	100	3
3	DUMSC203	General and Algebraic Topology	4	1	-	5	70	30	100	3
4	DUMSC204	Complex Analysis-II	4	1	-	5	70	30	100	3
5	DUMSC205	Advanced Discrete Mathematics-II	4	1	-	5	70	30	100	3
6	DUMSC206	Research Methodology	2	-	-	2	35	15	50	2
Total			**22**	**5**	**-**	**27**			**550**	**17**

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Advanced Abstract Algebra-II**				
Code	**DUMSC201**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	5	
Prerequisite	**NIL**				
Objective	The main aim of the course is to introduce you to basic concepts from abstract algebra, especially the notion of a group. The course will help prepare you for further study in abstract algebra as well as familiarize you with tools essential in many other areas of mathematics. The other aim of this module is to provide the learner with the skills, knowledge and competencies to carry out their duties and responsibilities in and pure Mathematic environment.				
Content	**Unit 1** Modules - Cyclic modules. Simple modules. Semi-simple modules. Schuler's Lemma. Free modules. Noetherian and artinian modules and rings-Hilbert basis theorem. Wedderburn Artin theorem. Uniform modules, primary modules, and Noether-Lasker theorem **Unit 2** Linear Transformations - Algebra of linear transformation, characteristic roots, matrices and linear transformations. **Unit 3** Canonical Forms - Similarity of linear transformations. Invariant subspaces. Reduction to triangular forms. Nilpotent transformations. Index of nilpotency. Invariants of a nilpotent transformation. The primary decomposition theorem. Jordan blocks and Jordan forms. **Unit 4** Smith normal form over a principal ideal domain and rank. Fundamental structure theorem for finitely generated modules over a Principal ideal domain and its applications to finitely generated abelian groups **Unit 5** Rational canonical form. Generalized Jordan form over any field.				
Outcome	At the end of the course, the students will be able to : 1. Demonstrate capacity for mathematical reasoning through Modules, different type of modules, Noether-Lasker theorem. 2. Understand the concept of characteristic roots, matrices and linear transformations 3. Understand the concepts of Canonical Forms, Nilpotent transformations, The primary decomposition theorem. Jordan blocks and Jordan forms. 4. Identify and analyze Smith normal form, Fundamental structure theorem etc. 5. Understand the concepts of Rational canonical form, Generalized Jordan.				

Recommended Books	**Books Recommended:** 1. P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul : Basic Abstract Algebra, Cambridge University press 2. I.N.Herstein : Topics in Albegra, Wiley Eastern Ltd. 3. QuaziZameeruddin and Surjeet Singh : Modern Algebra **References** 1. M.Artin, Algeabra, Prentice -Hall of India, 1991. 2. P.M. Cohn, Algebra,Vols.I,II&III, John Wiley & Sons, 1982,1989,1991. 3. N.Jacobson, Basic Algebra, Vols. I &II,W.H. Freeman, 1980 (also published by Hindustan Publishing Company). 4. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993. 5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol.II-Rings, Narosa Publishing House (Vol.l-1996,Vol. II-1999) 6. D.S.Malik, J.N.Mordeson, and M.K.Sen, Fundamentals of Abstract Algebra, Mc Graw-Hill, International Edition,1997. 7. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi,2000. 8. S.K.Jain,A. Gunawardena and P.B Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag),2001. 9. S.Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000. 10. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.

Signature of Members(BoS)

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Real Analysis-II**				
Code	**DUMSC202**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	**Nil**				
Objective	To learn the fundamentals of mathematical analysis: convergence of sequences and series, continuity, differentiability, Riemann integral, sequences and series of functions, uniformity, and the interchange of limit operations. It shows the utility of abstract concepts and teaches an understanding and construction of proofs.				
Content	**Unit 1** Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, integration and differentiation, the fundamental theorem of Calculus, integration of vector-valued functions, Rectifiable curves. **Unit 2** Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets. Integration of Non-negative functions. The General integral. Integration of Series. **Unit 3** Measures and outer measures, Extension of a measure. Uniqueness of Extension. Completion of a measure. Measure spaces. Integration with respect to a measure. Reimann and Lebesgue Integrals. **Unit 4** The Four derivatives. Lebesgue Differentiation Theorem. Differentiation and Integration **Unit 5** Functions of Bounded variation The L^p spaces Convex functions. Jensen's inequality. Holder and Minkowski inequalities. Completeness of L^p spaces. Convergence in Measure, Almost uniform convergence				
Outcome	At the end of the course, the students will be able to : 1. Understand the concept of existence of Riemann-Stieltjes integral, fundamental theorem of Calculus. 2. Understand the concept of Measurable sets, Non-measurable sets, Integration of Series. 3. Understand the concept of Extension of a measure, Reimann and Lebesgue Integrals. 4. Understand the concept of maxima and minima of real valued functions from R to R and from R ϑ to R. 5. Understand the concept of Integration theory that is closely related to the theory of Euclidean spaces and derivatives of functions of several variables.				

Recommended Books	**Recommended Books**: 1. Principle of Mathematical Analysis by W. Rudin 2. Real Analysis by H. L. Roydon **References** 1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985. 2. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975. 3. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968. 4. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981. 5. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969. 6. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000). 7. I.P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick Ungar Publishing Co., 1961.
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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**General and Algebraic Topology**				
Code	**DUMSC203**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	**NIL**				
Objective	Introduce the notion of homotopy, groups with pointed spaces and covering spaces which is closely associated with the fundamental groups. Moreover, tointroduce the concept of free groups and presentation of a group and to compute thefundamental group of wedge of circles, Klein bottle, adjunction of a disc and a path connected space.				
Content	**Unit 1** Tychonoff product topology in terms of standard sub-base and its characterizations. Projection maps. Separation axioms **Unit 2** Product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff's theorem). Countability and product spaces. **Unit 3** Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohnmetrization theorem. Metrization theorems and Paracompactness-Local finiteness. The Nagata-Smirnov metrization theorem. Paracompactness. The Smirnov metrization theorem. **Unit 4** Nets and filter. Topology and convergence of nets. Hausdorffness and nets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters and vice-versa. Ultra-filters and Compactness **Unit 5** 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				
Outcome	After completing this course a student will be able to CO1. learn Bolzano,Weierstrass property of a space and prove Tychonoff theorem. CO2. determine fundamental groups of some standard spaces like Euclidean spaces andspheres. CO3. understand Embedding and metrization and some beauty results such as Smirnov metrization theorem, Nagata-Smirnov metrization theorem. Paracompactness. CO4. find Hausdorff spaces using the concept of net in topological spaces and learn about 1stand 2nd countable spaces, separable and Lindelöf spaces. CO5. grasp the basics of Algebraic Topology.				

Recommended Books	**Recommended Books**: 1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi,2000. 2. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983. **References** 1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.). 2. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963. 3. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961. 4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995. 5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970. 6. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966. 7. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966. 8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977. 9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964. 10. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966

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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Advanced Complex Analysis-II**				
Code	**DUMSC204**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	**NIL**				
Objective	The primary objective of this course is to understand the notion of Gamma function and its properties. Riemann Zeta functionand Mittag-Leffler's theorem, Analytic Continuation, analytic and meromorphic functions, Schwarz Reflection Principle. Monodromy theorem and Harnack's inequality and theorem, Montel Caratheodory and the Great picard theorem. Univalent functions.				
Content	**Unit 1** Weierstrass'factorisation theorem. Gamma function and its properties. Riemann Zeta function. Riemann's functional equation. Runge's theorem. Mittag-Leffler's theorem. **Unit 2** Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation Schwarz Reflection Principle. Monodromy theorem and its onsequences. **Unit 3** Harmonic functions on a disk. Harnack's inequality and theorem. Dirichlet Problem. Green's function. **Unit 4** Canonical products. Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem. Order of an entire function. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem. **Unit 5** The range of an analytic function. Bloch's theorem. The Little Picard theorem. Schottky's theorem. Montel Caratheodory and the Great picard theorem. Univalent functions. Bieberbach's conjecture (Statement only) and the "1/4-theorem.				
Outcome	After studying this course the student will be able to CO1. understand theGamma function and its properties. Riemann Zeta function CO2. be familiar with Harnack's inequality and theorem. Dirichlet Problem. Green's function. CO3. appreciate Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem. CO4. know Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem. Order of an entire function. CO5. know Montel Caratheodory and the Great picard theorem. Univalent functions. Bieberbach's conjecture				

Recommended Books	**Recommended Books**: 1. L.V. Ahlfors, Complex Analysis, MCGraw - Hill, 1979. 3. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House,1980. **References** 1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990. 2. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996. 3. S. Lang, Complex Analysis, Addison Wesley, 1977. 4. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998. 5. E. Hille, Analytic Function Theory (2 Vols.) Gonn& Co., 1959. 6. W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.Van Nostrand Co., 1967. 7. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964. 8. M.Heins, Complex Function Theory, Academic Press, 1968. 9. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co.,1966. 10. S.Saks and A.Zygmund, Analytic Functions, MonograficMatematyczne, 1952.
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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Title	**Advanced Discrete Mathematics-II**				
Code	**DUMSC205**				
Credit	**L**	**T**	**P**	**Total**	
	4	**1**	**0**	**5**	
Prerequisite	**Basic knowledge of graph theory.**				
Objective	The aim of the discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous. In contrast to real numbers that have the property of varying "smoothly", the objects studied in discrete mathematics – such as integers, graphs, and statements in logic do not vary smoothly in this way, but have distinct, separated values. Discrete mathematics therefore excludes topics in "continuous mathematics" such as calculus and analysis. Discrete objects can often be enumerated by integers				
Content	**UNIT I** Graph Theory-Definition of (Undirected) Graphs, Paths, Circuits, Cycles, & Subgraphs. Induced Subgraphs. Degree of a vertex. Connectivity. Planar Graphs and their properties. Trees. Euler's Formula for connected planar Graphs. Complete & Complete Bipartite Graphs. Kuratowski's Theorem (statement only) and its use. **UNIT II** Spanning Trees, Cut-sets, Fundamental Cut -sets, and Cycle. Minimal Spanning Trees and Kruskal's Algorithm. Matrix Representations of Graphs. Euler's Theorem on the Existence of Eulerian Paths and Circuits. Directed **UNIT III** Graphs. In degree and Out degree of a Vertex. Weighted undirected Graphs. Dijkstra's Algorithm. strong Connectivity &Warshall's Algorithm. Directed Trees. Search Trees. Tree Traversals. **UNIT IV** Introductory Computability Theory-Finite State Machines and their Transition Table Diagrams. Equivalence of finite State Machines.Reduced Machines. Homomorphism. **UNIT V** Finite Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata. Moore and mealy Machines. Turing Machine and Partial Recursive Functions.				
Outcome	At the end of the course, the students will be able to : 1. Understand the concept of Graph Theory, Types and Operation of Graphs 2. Understand the Minimal Spanning Trees and Kruskal's Algorithm. 3. Understand the Dijkstra's Algorithm. strong Connectivity &Warshall's Algorithm 4. Understand Finite State Machines and Equivalence of finite State Machines5.Understand Finite Automata ,Turing Machine and Partial Recursive Functions..				

Recommended Books	**Recommended Books**: 1. Elements of Discrete Mathematics By C.L.Liu 2. Graph Theory and its application By N.Deo 3. Theory of Computer Science By K.L.P.Mishra and N.Chandrashekaran **References** 1. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997. 2. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York. 3. Seymour Lepschutz, Finite Mathematics (International) edition 1983), McGraw-Hill Book Company, New York. 4. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co. 5. J.E. Hopcroft and J.D Ullman, Introduction to Automata Theory, Languages & Computation, Narosa Publishing House. 6. C.L Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co. 7. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. Prentice Hall of Indi
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TWO YEAR POSTGRADUATE PROGRAMME
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Course Title: Research Methodology

Credit Units: 02

L	T	P	TOTAL CREDITS
2	0	0	2

Course Objectives: The course aims to enable the students learn the concepts of Research techniques andit'sapplicabilityinthevariousminorandmajorresearches.Fundamentalsofresearchwithspecific reference to quantitative research methods would facilitate the students towards exploring the area of their interest.

Course Outcome: The paper focusesonthetheoreticalaspectofsamplingmethods,typesofscientific methods and their usage in researches. It also enhances the students' knowledge about the stages of conductive research methods.

UNIT-I Research: An Introduction

a) Types of Scientific Methods: Hypothetic-Deductive and Inductive Research

b) TypesofResearch:Basicvs.Applied,Quantitativevs.QualitativeResearch

c) Principles of a Good Research

UNIT-II The Research Process

a) Stages of conducting a Research

b) Problem and Hypothesis:Definition,Types

c) Variables:Types,Operationaldefinition

UNIT-III Behavioral Research I

a) Control of Extraneous Variables

b) Laboratory experiments, Field Experiments

c) Field study, Survey

UNIT-IV Behavioral Research II

a) Research: Causality and It's criteria

b) Threats to Internal and External Validity

c) Non-Experimental Research: Co-relational Research, Survey Research, Archival Research

d) Sampling Issues: Representativeness and Adequacy

e) Sampling Strategies: Probability and Non-probability Sampling, Sampling Errors

Books Recommended:

- Aronson,E.andEllsworthD.C.,Carlsmith,J.M.,Gonzales,M.I.

  (1990).Method so research in Social Psychology.McGrawHill International Edition
- Breakwell,G.M.,Hammond,SandSchow,C.F.(Edited)(1995).ResearchMethodsinPsychology. Sage Publications
- Ebnes,D.G,Kantowitz,B.M.,Roediger,H.L,(1989).ResearchMethodsinPsychology.West Publishing Company
- Greenberg, Jand Folger, R (1988). Controver sial Issues in Social Research Method. New York.Springerverlag
- Katz,D. and Festinger, L. (1953). Research Methods in Behavioral Sciences. Holt, Rinehart and Winston, Inc
- Kerlinger,F.N.(1964).FoundationsofBehavioralResearch.Holt,RinehartandWinston,Inc
- Mohsin,S.M.(1984).ResearchMethodsinBehavioralSciences.OrientLongmanLtd
- Schaugneassey,J.J.,Zechmeister,B(1990).ResearchMethodsinPsychology.McGrawhill Publishing Company, New Delhi
- SommerandSommer,R(1997).APracticalGuidetoBehavioralResearch.OxfordUniversityPress
- Weiner,B.J.,Brown,D.R.,Michels,K.M.(1991).StatisticalPrinciplesinExperimentalDesign