MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI 627 012

DEPARTMENT OF MATHEMATICS

UNIVERSITY DEPARTMENT

M.Phil - Mathematics (CBCS)

(From the academic year 2016-17)

1. ELIGIBILITY AND ADMISSION

Pass in M.Sc Mathematics with 55 % of marks. SC/ST students will be given 5% concession as per the norms of Government of Tamil Nadu. The students will be admitted to the course through an Entrance Examination. The selection will be based on 50% to marks for M.Sc Mathematics course and 50 % to marks obtained in the entrance examination

Course Structure

S.No.	Semester	Subject	Credits	Hours /week	Maximum Marks			Passing Minimum	
					Int.	Ext.	Tot.	Ext.	Tot.
1	I	**Core -I (Theory):** Research Methodology Commutative Algebra	8	8	25	75	100	38	50
2	I	**Core – I (Theory) :** Banach Algebra and Spectral Theory	8	8	25	75	100	38	50
3	I	**Elective –I (Theory):** 1. Advanced Graph 2. Theory 2. Harmonic Analysis 3. Parallel Algorithms 4. Theory of Near rings 5. Advanced Calculus **6.** Algebraic Graph Theory.	8	8	25	75	100	38	50
4	II	**Project and Viva-voce**	16	-	25	75	100	38	50
Total			40	-	-	-	100	-	-

MSU/2016-17/ Univ.Depts/ M.Phil (Maths)/Semester -I/Ppr.-1/Core-I

Commutative Algebra

Unit I: Rings and Ideals – Modules

Unit II: Rings and Modules fractions – Primary Decomposition

Unit III: Integral Dependence and valuations – Chain conditions'

Unit IV: Noetherian Rings – Artin Rings

Unit V: Discrete valuation rings and Dedekind domains

Text Book: Content and Treatment as in Atiyah and Macdonald, Introduction to Commutative Algebra, Chapters 1 to 9.

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Banach Algebra and Spectral Theory

Unit I: Banach algebras – Complex Homomorphisms – Basic properties of Spectra – Symbolic Calculus.

Unit II: Differentiation - Group of invertible elements – Commutative Banach algebra – Ideals and Homomorphisms – Gelfand transforms.

Unit III: Involutions – Applications to non commutative algebra – Positive Linear functionals.

Unit IV: Bounded Operators on Hilbert spaces – Bounded Operators – A commutativity theorem – Resolution of the Identity – Spectral theorem.

Unit V: Eigen values of normal operators – Positive operators and square roots – Group of invertible operators – Characterization of V* algebra.

Text Book: Content and Treatment as in Rudin, Functional Analysis, Tata McGraw Hill, Chapters 10,11 & 12.

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Advanced Graph Theory

Unit I: Dominating sets in graphs - Bounds on the domination number: in terms of order, degree, size, degree, diameter and girth.

Unit II: Product graphs and Vizing's conjecture – Domatic number - Nordhaus-Gaddum type theorems - dominating functions.

Unit III: Decompositions and colorings of a graph – Generalizations of graph decompositions.

Unit IV: Necessary conditions for the existence of a G-decomposition of a graph-Cycle decompositions, Vertex labelings and graceful graphs.

Unit V: Perfect graphs: The perfect graph theorem – p-critical and partitionable graphs – A polyhedral characterization of perfect graphs and p-critical graphs – The strong perfect graph conjecture (and recent theorem).

Text Books: Content and Treatment as in

1) Teresa W. Haynes, Stephen T. Hedetniemi and Peter J. Slater, Fundamentals of Domination in graphs, Marcel Decker (1998), Section 1.2, 2.1to2.4 (For Unit I)
   Sections 2.6, 8.3, 9.1 and 10.1 to10.3 (for Unit II)

2) Juraj Bosak, Decompositions of graphs , Kluwar Academic Publishers, Chapters 2, 3 4, 6 and 7. (for Units III and IV)

3) Martin Charles Golumbic, Algorithmic graph theory, Academic Press, Chapter 3 (for Unit V)

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Harmonic Analysis

Unit I: Fourier series and integrals – Definitions and easy results – The Fourier transform – Convolution – Approximate identities – Fejer's theorem – Unicity theorem – Parselval relation – Fourier Stieltjes Coefficients – The classical kernels.

Unit II: Summability – Metric theorems – Pointwise summability – Positive definite sequences – Herglotz;s theorem – The inequality of Hausdorff and Young.

Unit III: The Fourier integral – Kernels on R. The Plancherel theorem – Another convergence theorem – Poisson summation formula – Bachner's theorem – Continuity theorem.

Unit IV: Characters of discrete groups and compact groups – Bochners' theorem – Minkowski's theorem.

Unit V: Hardy spaces- Invariant subspaces – Factoring F and M. Rieza theorem – Theorems of Szego and Beuoling.

Text Book: Content and Treatment as in Henry Helson, Harmonic Analysis, Hindustan Book Agency, Chapters 1.1 to 1.9, 2.1 to 3.5 and 4.1 to 4.3.

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Parallel Algorithms

Unit I: Foundations of parallel computing – Elements of parallel computing.

Unit II: Data structures for Parallel Computing.

Unit III: Paradigms for Parallel Algorithms- Simple algorithms.

Unit IV: Tree algorithms

Unit V: Algebraic Equations and matrices

Text Book: Content and Treatment as in C. Xavier and S.S. Iyengar, Introduction to Parallel Algorithms, Chapters 1,2,3,4,5 and 10.

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Theory of Near-Rings

Unit I: The elements of theory of near-rings.

Unit II: Ideal theory

Unit III: Elements of structure theory

Unit IV: Near-fields

Unit V: More classes of near-rings.

Text Book: Content and Treatment as in G. Pilz, Theory of Near-rings, North Holland, Chapters 1,2,3, 8(a), 9(a) and 9(b).

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Advanced Calculus

Unit I : Differentiation – Basic theorems – Partial derivatives – Derivatives – Inverse functions.

Unit II : Implicit functions – Integration – Measure zero and Content zero – Integrable functions.

Unit III : Fubini's theorem – Partitions of Unity – Change of Variables.

Unit IV : Integration on chains – Algebraic preliminaries – Fields and Forms –Geometric preliminaries – The fundamental theorem of Calculus.

Unit V : Manifolds – Fields and Forms on Manifolds – Stokes' theorem on Manifolds - The Volume element – The Classical theorems.

Text book : Calculus on Manifolds by Michael Spivak, The Benjamin / Cummings Publishing Company

References : (1) Mathematical Analysis by Tom M. Apostol, Narosa Publishing Company.

(2) Advanced Calculus by Gerald B.Folland, Pearson Publishing Company.

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Algebraic Graph Theory

Unit 1: Linear Algebra in graph theory: The spectrum of a graph – Regular graphs and line graphs - The homology of graphs.

Unit 2: Spanning trees and associated structures – Complexity – Determinant expansions.

Unit 3: Symmetry and regularity of graphs: General properties of graph automorphisms – Vertex-transitive graphs – Symmetric graphs – Trivalent symmetric graphs.

Unit 4: The Covering - graph construction – Distance-transitive graphs - The feasibility of intersection arrays.

Unit 5: The Laplacian of a graph: The Laplacian matrix – trees – representations – energy and eigenvalues – connectivity – the generalized Laplacian – Multiplicities – embedding.

Text Books:

1. **Norman Biggs,** Algebraic Graph Theory, Cambridge University Press, London, 1974. Chapters 2, 3 and 4 for Unit I, 5, 6 and 7 for Unit II,C 15, 16, 17 and 18 for Unit III,19, 20 and 21 for Unit IV.

2. **Chris Godsil, Gordon Royle,** Algebraic Graph Theory, Springer-Verlag, New York, 2006. Chapter 13 (Sections 13.1 to 13.6, 13.9 to 13.11) for Unit V.

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