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M.Sc. (Mathematics) Semester-I (July 2026-Dec 2026)

ADVANCED ABSTRACT ALGEBRA (I)

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	Groups - Normal and Subnormal series. Composition series. Jordan-Holder theorem. Solvable groups. Nilpotent groups.	15	1
II	Field theory- Extension fields. Algebraic and transcendental extensions. Separable and inseparable extensions.	15	2
III	Perfect fields. Finite fields. Primitive elements. Algebraically closed fields.	18	3
IV	Normal extensions. Automorphism of extensions. Galois extensions. Fundamental theorem of Galois theory.	17	4
V	Solution of polynomial equations by radicals. Insolvability of the general equation of degree 5 by radicals.	10	5

Books Recommended:

1. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, *Basic Abstract Algebra*, Cambridge University press, 1994
2. I. N. Herstein, *Topics in Algebra*, Wiley Eastern Ltd., 1999
3. Quazi Zameeruddin, Surjeet Singh, *Modern Algebra*, Vikas Publishing House Pvt. Ltd., 1990

Reference Books:

1. M. Artin, *Algebra*, 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
4. S. Lang, *Algebra*, 3rd edition, Addison-Wesley, 1993.
5. I.S. Luther, I.B.S. Passi, *Algebra*, Vol. I-Groups, Vol. II-Rings, Narosa Publishing House (Vol. I-1996, Vol. II-1999)
6. D.S. Malik, J. N. Mordeson, M. K. Sen, *Fundamentals of Abstract Algebra*, Mc Graw-Hill, International Edition, 1997.
7. Vivek Sahai and Vikas Bist, *Algebra*, Narosa Publishing House, 1999.
8. I. Stewart, *Galois theory*, Chapman and Hall, 1989.
9. J.P. Escofier, *Galois theory*, GTM Vol.204, Springer, 2001.
10. J.B. Fraleigh, *A first course in Algebra*, Narosa, 1982.

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REAL ANALYSIS (I)

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, Weierstrass approximation theorem.	18	1
II	Power series, uniqueness theorem for power series, Abel's and Tauber's theorems. Rearrangements of terms of a series, Riemann's theorem.	12	2
III	Functions of several variables, linear transformations, Derivatives in an open subset of R^n , Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem.	15	3
IV	Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals.	12	4
V	Partitions of unity, Differential forms, Stoke's theorem.	18	5

Books Recommended:

1. Walter Rudin, *Principle of Mathematical Analysis*, (3rd Edition) McGraw-Hill, Kogakusha, 1976.
2. H. L. Roydon, *Real Analysis*, Macmillan Pub. Co. Inc. (4th Edition), New York, 1962.

Reference Books:

1. T.M. Apostol, *Mathematical Analysis*, Narosa Publishing House, New Delhi, 1985.
2. G. 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. B. 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 Pvt. Ltd., New Delhi, 1986.
7. I.P. Natanson, *Theory of Functions of a Real Variable*. Vol. 1, Frederick Ungar Publishing Co., 1961.
8. R. L. Wheeden and A. 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.
11. P.R. Halmos, *Measure Theory*, Van Nostrand, Princeton, 1950.
12. R.G. Bartle, *The Elements of Integration*, John Wiley & Sons, Inc. New York, 1966.
13. Serge Lang, *Analysis I & II*, Addison-Wesley Publishing Company, Inc. 1969.
14. Inder K. Rana, *An Introduction to Measure and Integration*, Narosa Publishing House, Delhi, 1997.
15. Walter Rudin, *Real & Complex Analysis*, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 1966.

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M.Sc. (Mathematics) Semester-I (July 2026-Dec 2026)**TOPOLOGY****Detailed Syllabus:**

Unit No.	Topics	No. of Lectures	CO No.
I	Countable and uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem. Cantor's theorem and the continuum hypothesis. Zorn's lemma, well-ordering theorem.	15	1
II	Definition and examples of topological spaces. Bases and sub-bases. Subspaces and relative topology. Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism.	19	2
III	First and Second Countable spaces. Lindelof's theorems. Separable spaces. Second countability and separability. Separation axioms; their Characterizations and basic properties. Urysohn's lemma, Tietze extension theorem.	19	3
IV	Compactness. Continuous functions and compact sets. Basic properties of Compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one-point compactification. Stone-Cech compactification.	11	4
V	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.	11	5

Books Recommended:

1. James R. Munkres, *Topology*, (2nd Edition) Pearson Education, New Delhi, 2021.
2. K. D. Joshi, *Introduction to General Topology*, (3rd Edition), New Age International Pvt. Ltd., India, 2022.

Reference Books:

1. J. Dugundji, *Topology*, Allyn and Bacon, Prentice Hall of India Pvt. Ltd., India, 1966.
2. G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw Hill Education, 2017.
3. J. Hocking, *G. Young Topology*, New Edition, Dover Publications Inc, 1988.
4. J. L. Kelley, *General Topology*, Reprint Edition, Dover Publications Inc., 2017.
5. L. Steen, J. A. Jr. Seebach, *Counterexamples in Topology*, , Second Edition, Springer, 1978.
6. W. Thron, *Topologically Structures*, Holt, Rinehart and Winston, New York, 1966.
7. N. Bourbaki, *General Topology*, Springer, 1998.
8. R. Engelking, *General Topology*, Heldermann Verlag, 1989.
9. W. J. Pervin, *Foundations of General Topology*, Academic Press Inc. 2014.
10. E. H. Spanier, *Algebraic Topology*, McGraw-Hill, New York, 1966.
11. S. Willard, *General Topology*, Dover, 2004.
12. Crump W. Baker, *Introduction to Topology*, Krieger Publishing Company, 1996.
13. Sze-Tsen Hu, *Elements of General Topology*, Vakils, Feffer and Simons Pvt. Ltd., 1972.
14. D. Bushaw, *Elements of General Topology*, First Edition John Wiley & Sons, New York, 1963.
15. M. J. Mansfield, *Introduction to Topology*, Princeton, N.J. Van Nostrand, 1963.
16. E. M. Eidelson, *Introduction to Topology*, Allyn & Bacon, Inc., Boston, 1962.
17. C. Berge, *Topological Spaces*, Macmillan Company, New York, 1963.
18. S. S. Coirns, *Introductory Topology*, Ronald Press, New York, 1968.
19. Z. P. Mamuzic, *Introduction to General Topology*, P. Noordhoff Ltd., Groningen, 1963.

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ADVANCED COMPLEX ANALYSIS (I)

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	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 of algebra. Taylor's theorem. Laurent's series. Isolated singularities. Meromorphic functions.	19	1
II	Maximum modulus principle. Schwarz lemma. The argument principle. Rouché's theorem, Inverse function theorem.	12	2
III	Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\text{Arg } z$, $\log z$ and z^a .	12	3
IV	Bilinear transformations, their properties and classifications. Definitions and examples of Conformal mappings.	14	4
V	Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem.	18	5

Books Recommended:

1. L. V. Ahlfors, *Complex Analysis*, McGraw - Hill, 1979.
2. J.B. Conway, *Functions of one Complex variable*, Narosa Publishing House, 1980.

Reference Books:

1. H.A. Priestly, *Introduction to Complex Analysis*, Clarendon Press, Oxford, 1990.
2. D. Sarason, *Complex Function Theory*, (2nd Edition) American Mathematical Society, 2007.
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. Mark J. Ablowitz and A.S. Fokas, *Complex Variables: Introduction and Applications*, Cambridge University press, South Asian Edition, 1998.
6. E. Hille, *Analytic Function Theory* (2 Vols.) Gonn & Co., 1959.
7. W.H.J. Fuchs, *Topics in the Theory of Functions of one Complex Variable*, D.Van Nostrand Co., 1967.
8. C. Caratheodory, *Theory of Functions* (2 Vols.) Chelsea Publishing Company, 1964.
9. M. Heins, *Complex Function Theory*, Academic Press, 1968.
10. Walter Rudin, *Real and Complex Analysis*, McGraw-Hill Book Co., 1966.
11. S. Saks and A. Zygmund, *Analytic Functions*, Monografic Matematyczne, 1952.
12. E.C Titchmarsh, *The Theory of Functions*, Oxford University Press, London, 1939.
13. W.A. Veech, *A Second Course in Complex Analysis*, W.A. Benjamin, 1967.
14. S. Ponnusamy, *Foundations of Complex Analysis*, Narosa Publishing House, 1997.

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ADVANCED DISCRETE MATHEMATICS (I)

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	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).	11	1
II	Homomorphism of semigroups and monoids. Congruence relation and Quotient Semigroups. Sub-semigroup and sub-monoids. Direct Products. Basic Homomorphism Theorem.	12	2
III	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.	13	3
IV	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.	13	4
V	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. Notions of Syntax Analysis, Polish Notations. Conversion of Infix Expressions to Polish Notations. The Reverse Polish Notation.	11	5

Books Recommended:

1. C. I. Liu, *Elements of Discrete Mathematics*, McGraw Hill Education India, 1986
2. J.P. Tremblay & R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill Book Co., 1997.

Reference Books:

1. J.L. Gersting, *Mathematical Structures for Computer Science*, W.H. Freeman and Company, 2003.
2. Seymour Lipschutz, *Finite Mathematics*, McGraw-Hill Book Company, 1983.
3. S. Witala, *Discrete Mathematics-A Unified Approach*, McGraw-Hill Book Co., 1987
4. J.E. Hopcroft and J.D Ullman, *Introduction to Automata Theory, Languages & Computation*, Narosa Publishing House, 2001
5. N. Deo, *Graph Theory with Application to Engineering and Computer Sciences*, Prentice Hall of India, 1979
6. K. L. P. Mishra and N. Chandrashekar, *Theory of Computer Science*, Prentice Hall of India, 200

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INDIAN KNOWLEDGE SYSTEM (IKS)- Concepts and Mathematics Tradition

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Indian Knowledge System (IKS) – An Introduction: What is IKS? Why do we need IKS? Organization of IKS. Historicity of IKS. Some salient aspects of IKS.	6
II	The Vedic Corpus: Introduction to Vedas. A synopsis of the four Vedas. Sub-classification of Vedas. Messages in Vedas. Introduction to Vedāṅgas. Prologue on Śikṣā and Vyākaraṇa. Basics of Nirukta and Chandas. Introduction to Kalpa and Jyotiṣa. Vedic Life: A Distinctive Features.	6
III	Wisdom through the Ages: Gateways of ancestral wisdoms. Introduction to Purāṇa. The Purāṇic repository. Issues of interest in Purāṇas. Introduction to Itihāsas. Key messages in Itihāsas. Wisdom through Niti-śāstras. Wisdom through Subhāṣita.	6
IV	Number Systems and Units of Measurement: Number systems in India – Historical evidence. Salient aspects of Indian Mathematics. Bhūta-Saṃkhyā system. Kaṭapayādi system. Measurements for time, distance, and weight. Piṅgala and the binary system.	6
V	Indian Mathematics Tradition: Introduction to Indian Mathematics. Unique aspects of Indian Mathematics. Indian Mathematicians and their Contributions. Algebra, Geometry, Trigonometry. Binary mathematics and combinatorial problems in Chandaḥ Śāstra. Magic squares in India.	6

Books Recommended:

B. Mahadevan, Vinayak Rajat Bhat, R.N. Nagendra Pavana, Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt. Ltd., 2022

Reference Books:

1. K. Kapur A.K. Singh (Eds), Indian Knowledge Systems, Vol. 1 & 2. D.K. Printworld Pvt. Ltd., 2005
2. , , (), -1, , 2018.
3. S. B. Rao, Indian Mathematics and Astronomy: Some Landmarks (Revised Third Edition), Bhartiya Vidhya Bhavan, 2012,
4. G.G. Josheph, Indian Mathematics: Engaging with the World from Ancient to Modern Times, speaking Tiger, 2016
5. B.S. Yadav, Ancient Indian Leaps into Mathematics, Birkausher Publication, 2010
6. Dharampal, Indian Science and Technology in the Eighteenth Century, Other India Press, 2000
7. Dharampal, The Beautiful Tree: Indigenous Indian Education in the Eighteenth Century, Other India Press, 2000