Mathematics

Semester 1 (AUG)

UM 101: Analysis and Linear Algebra I (3:0)
One-variable calculus: Real and Complex numbers; Convergence of sequences and series; Continuity, intermediate value theorem, existence of maxima and minima; Differentiation, mean value theorem, Taylor series; Integration, fundamental theorem of Calculus, improper integrals. Linear Algebra: Vector spaces (over real and complex numbers), basis and dimension; Linear transformations and matrices.

Instructor: A. Ayyer

Suggested books:

1. T M Apostol, Calculus, Volume I, 2nd. Edition, Wiley, India, 2007.
2. G. Strang, Linear Algebra And Its Applications, 4th Edition, Brooks/Cole, 2006.

Semester 2 (JAN)

UM 102: Analysis and Linear Algebra II (3:0)

Linear Algebra continued: Inner products and Orthogonality; Determinants; Eigenvalues and Eigenvectors; Diagonalisation of Symmetric matrices. Multivariable calculus: Functions on R^n Partial and Total derivatives; Chain rule; Maxima, minima and saddles; Lagrange multipliers; Integration in R^n, change of variables, Fubini's theorem; Gradient, Divergence and Curl; Line and Surface integrals in R^2 and R^3; Stokes, Green's and Divergence theorems.
Introduction to Ordinary Differential Equations; Linear ODEs and Canonical forms for linear transformations.

Instructor: T. Bhattacharyya

Suggested books:

1. T. M. Apostol, Calculus, Volume II, 2nd. Edition, Wiley Wiley India, 2007.
2. G. Strang, Linear Algebra And Its Applications, 4th Edition, Brooks/Cole, 2006
3. M. Artin, Algebra, Prentice Hall of India, 1994.
4. M. Hirsch, S. Smale, R. L. Devaney, Differential Equations, Dynamical Systems, and an Introduction to Chaos, 2nd Edition, Academic Press, 2004.

Semester 3 (AUG)

UM 201: Probability and Statistics (3:0)

Basic notions of probability, conditional probability and independence, Bayes' theorem, random variables and distributions, expectation and variance, conditional expectation, moment generating functions, limit theorems. Samples and sampling distributions, estimations of parameters, testing of hypotheses, regression, correlation and analysis of variance.

Instructor: S. Iyer

Suggested books:
1. **Sheldon Ross, A First Course in Probability, 2005, Pearson Education Inc., Delhi, Sixth Edition.**
2. **Sheldon Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 2010, Fourth edition.**
3. **William Feller, An Introduction to Probability Theory and Its Applications, Wiley India, 2009, Third edition.**
4. **R. V. Hogg and J. Ledolter, Engineering Statistics, 1987, Macmillan Publishing Company, New York**.

Semester 4 (JAN)

UM 202: Multivariable Calculus and Complex Variables (3:0) (core course for Mathematics major and minor)

Topolgy of $\mathbf{R}^n$: Notions of compact sets and connected sets, the Heine-Borel theorem, uniform continuity, Cauchy sequences and completeness. Review of total derivatives, inverse and implicit function theorems. Review of Green's theorem and Stokes' theorem. Complex linearity, the Cauchy-Riemann equations and complex-analytic functions. Möbius transformations, the Riemann sphere and the mapping properties of Möbius transformations. Some properties of complex-analytic functions, and examples.

Instructor: G. Bharali

Suggested books:
1. T.M. Apostol, Calculus, Volume II, 2nd. Edition, Wiley India, 2007.
2. T.W. Gamelin, Complex Analysis, Springer Undergraduate Texts in Mathematics, Springer International Edition, 2006

UM 203: Elementary Algebra and Number Theory (3:0) (core course for Mathematics major and minor)

Divisibility and Euclid's algorithm, Fundamental theorem of Arithmetic, Congruences, Fermat's little theorem and Euler's theorem, the ring of integers modulo n, factorisation of polynomials, Elementary symmetric functions, Eisenstein's irreducibility criteria, Formal power series, arithmetic functions, Prime residue class groups, quadratic reciprocity. Basic concepts of rings, Fields and groups. Applications to number theory.

Instructor: S. Das

Suggested books:
1. D. M. Burton, Elementary number theory, McGraw Hill.

2. Niven, H. S. Zuckerman and H. L. Montgomery, An Introduction To The Theory Of Numbers, 5^{th} Edition, Wiley Student Editions
3. G. Fraleigh, A First Course in Abstract Algebra, 7th Edition, Pearson.

Semester 5 (AUG)

MA 212: Algebra (3:0) (core course for Mathematics major and minor)

Groups: Review of Groups, Subgroups, Homomorphisms, Normal subgroups, Quotient groups, Isomorphism theorems. Group actions and its applications, Sylow theorems. Structure of finitely generated abelian groups, Free groups. Rings: Review of rings, Homomorphisms, Ideals and isomorphism theorems. Prime ideals and maximal ideals. Chinese remainder theorem. Euclidean domains, Principal ideal domains, Unique factorization domains. Factorization in polynomial rings. Modules: Modules, Homomorphisms and exact sequences. Free modules. Hom and tensor products. Structure theorem for modules over PIDs.

Instructor: A. Banerjee

Suggested books:

1. Lang, S., Algebra, revised third editiom. Springer-Verlag, 2002 (Indian Edition Available).
2. Artin, M., Algebra, Prentice-Hall of India, 1994.
3. Dummit, D. S. and Foote, R. M., Abstract Algebra, John Wiley & Sons, 2001.
4. Hungerford, T. W., Algebra, Springer (India), 2004
5. Herstein, I. N., Topics in Algebra, John Wiley & Sons, 1995.

MA 219: Linear Algebra (3:0) (core course for Mathematics major and minor)

Vector spaces: Basis and dimension, Direct sums. Determinants: Theory of determinants, Cramer's rule. Linear transformations: Rank-nullity theorem, Algebra of linear transformations, Dual spaces. Linear operators, Eigenvalues and eigenvectors, Characteristic polynomial, Cayley- Hamilton theorem, Minimal polynomial, Algebraic and geometric multiplicities, Diagonalization, Jordan canonical Form.
Symmetry: Group of motions of the plane, Discrete groups of motion, Finite groups of S0(3).
Bilinear forms: Symmetric, skew symmetric and Hermitian forms, Sylvester's law of inertia, Spectral theorem for the Hermitian and normal operators on finite dimensional vector spaces.
Linear groups: Classical linear groups, SU2 and SL 2(R).

Instructor: P. Singla

Suggested books:

1. Artin, M., Algebra, Prentice-Hall of India, 1994.
2. Herstein, I. N., Topics in Algebra, Vikas Publications, 1972.
3. Strang, G., Linear Algebra and its Applications, Third Edition, Saunders, 1988.
4. Halmos, P., Finite dimensional vector spaces, Springer-Verlag (UTM), 1987.

MA 221: Real Analysis (3:0) (core course for Mathematics major and minor)

Review of Real and Complex numbers systems, Topology of R, Continuity and differentiability, Mean value theorem, Intermediate value theorem. The Riemann-Stieltjes integral. Introduction to functions of several variables, differentiablility, directional and total derivatives. Sequences and series of functions, uniform convergence, the Weierstrass approximation theorem.

Instructor: T. Gudi

Suggested books:

1. Rudin, W., Principles of Mathematical Analysis, McGraw-Hill, 1986.
2. Royden, H. L., Real Analysis, Macmillan, 1988.

MA 231: Topology (3:0) (core course for Mathematics major)

Open and closed sets, continuous functions, the metric topology, the product topology, the ordered topology, the quotient topology. Connectedness and path connectedness, local path connectedness. Compactness. Countability axioms. Separation axioms. Complete metric spaces, the Baire category theorem. Urysohn's embedding theorem. Function. Topological groups, orbit spaces.

Instructor: B. Datta

Suggested books:

1. Armstrong, M. A., Basic Topology, Springer (India), 2004.
2. Janich, K., Topology, Springer-Verlag (UTM), 1984.
3. Munkres, K. R., Topology, Pearson Education, 2005.
4. Simmons, G. F., Topology and Modern Analysis, McGraw-Hill, 1963.

Semester 6 (JAN)

MA 222: Measure Theory (3:0) (core course for Mathematics major)

Construction of the Lebesgue measure, measurable functions, limit theorems. Lebesgue integration. Different notions of convergence and convergence theorems. Product measures and the Radon-Nikodym theorem, change of variables, complex measures.

Instructor: H. Seshadri

Suggested books:

1. Hewitt, E. and Stromberg, K., Real and Abstract Analysis, Springer, 1969
2. Royden, H.L., Real Analysis, Macmillan, 1988.
3. Folland, G.B., Real Analysis: Modern Techniques and their Applications, 2nd edition, Wiley.

MA 224: Complex Analysis (3:0) (core course for Mathematics major)

Complex numbers, complex-analytic functions, Cauchy's integral formula, power series, Liouville's theorem. The maximum-modulus theorem. Isolated singularities, residue theorem, the Argument Principle, real integrals via contour integration. Mobius transformations, conformal mappings. The Schwarz lemma, automorphisms of the dis. Normal families and Montel's theorem. The Riemann mapping theorem.

Instructor: S. Thangavelu

Suggested books:

1. Ahlfors, L. V., Complex Analysis, McGraw-Hill, 1979.
2. Conway, J. B., Functions of One Complex Variable, Springer-veriag, 1978.
3. Gamelin, T.W., Complex Analysis, UTM, Springer, 2001.

MA 241: ODE (3:0) (core course for Mathematics major)

Basics concepts: Phase space, existence and uniquness theorems, dependence on initial conditions, flows.
Linear systems: The fundamental matrix, stability of equilibrium points. Sturm-Liouvile theory.
Nonlinear systems and their stability: The Poincare-Bendixson theorem, perturbed linear systems, Lyapunov methods.

Instructor: G. Rangarajan

Suggested books:

1. Coddington, E. A. and Levinson, N., Theory of Ordinary Differential Equations, Tata McGraw-Hill 1972.
2. Birkhoff, G. and Rota, G.-C., Ordinary Differential Equations, wiley, 1989.
3. Hartman, P., Ordinary Differential Equations, Birkhaeuser, 1982.

Semester 7 (AUG)

The coursework for this semester comprises five electives.
See below for the list of electives offered by the Department of Mathematics.

Semester 8 (JAN)

The work for this semester consists of one elective course and the undergraduate project.
The undergraduate project carries 13 credits**.**
See below for the list of electives offered by the Department of Mathematics.

List of electives offered by the Department of Mathematics

ELECTIVES OFFERED IN THE AUGUST-DECEMBER SEMESTER

MA 223: Functional Analysis (3:0)

Basic topological concepts, metric spaces, normed linear spaces, Banach spaces, bounded linear functionals and dual spaces, the Hahn-Banach Theorem, bounded linear operators, open-mapping theorem, closed-graph theorem, the Banach-Steinhaus Theorem, Hilbert spaces, the Riesz Representation Theorem, orthonormal sets, orthogonal complements, bounded operators on a Hilbert space up to the spectral theorem for compact, self-adjoint operators.

Instructor: S. Thangavelu

Suggested books:
1. Goffman, C. and Pedrick, G., First Course in Functional Analysis, Prentice-Hall of India, 1995.
2. Conway, J. B., A Course in Functional Analysis, Springer, 1990.
3. Rudin, W., Functional Analysis, 2nd Edition, Tata McGraw-Hill, 2006.
4. Yosida, K., Functional Analysis, 4th Edition, Narosa Publishing House, 1974.

MA 226: Complex Analysis II (3:0)

Harmonic and subharmonic functions, Green's function, and the Dirichlet problem for the Laplacian; the Riemann mapping theorem (revisited) and characterizing simple connectedness in the plane; Picard's theorem; the inhomogeneous Cauchy–Riemann equations and applications; covering spaces and the monodromy theorem.

Instructor: Jaikrishnan J. / Gautam Bharali

Suggested books:
1. Narasimhan, R., Complex Analysis in One Variable, 1st ed. or 2nd ed. (with Y. Nievergelt), Birkhauser (2nd ed. is available in Indian reprint, 2004).
2. Greene, R.E. and Krantz, S.G., Function Theory of One Complex Variable, 2nd ed., AMS 2002 (available in Indian reprint, 2009, 2011).

MA 232: Introduction to Algebraic Topology (3:0)

The fundamental group: Homotopy of maps, multiplication of paths, the fundamental group, induced homomorphisms, the fundamental group of the circle, covering spaces, lifting theorems, the universal covering space, Seifert-van Kampen theorem, applications.
Simplicial complexes, Simplicial- and singular-homology: definitions, properties and applications.

Instructor: S. Gadgil

Suggested books:
1. Armstrong, M. A., Basic Topology, Springer (India), 2004.
2. Hatcher, A., Algebraic Topology, Cambridge Univ. Press, 2002.
3. Kosniowski, C., A First Course in Algebraic Topology, Cambridge Univ. Press, 1980.

MA 242: Partial Differential Equations (3:0)

First-order partial differential equations and Hamilton-Jacobi equations; the Cauchy problem and classification of second-order equations, Holmgren's uniqueness theorem; the Laplace equation; the diffusion equation; the wave equation; some methods of solutions, variables separable method.

Instructor: M. K. Ghosh

Suggested books:

1. John, F., Partial Differential Equations, Springer (International Students Edition), 1971.
2. Evans, L. C., Partial Differential Equations, AMS, 1998.

MA 317: Introduction to Number Theory (3:0)

Part I: Factorization and prime numbers, congruences, primitive roots, quadratic residues, continued fractions, irrational numbers, approximation of irrationals by rationals, some Diophantine equations, algebraic and transcendental numbers.
Part II: Arithmetical functions, averages of arithmetical functions, summation formulas, distribution of primes-I (elementary estimates), Dirichlet series and Euler products, introduction to the Riemann zeta function.

Instructor: S. Das

Suggested books:

1. Hardy, G.H. and Wright, E.M., An Introduction to the Theory of Numbers (6th ed, Oxford University Press, (2008).
2. Ireland, K. and Rosen, M., A Classical Introduction to Modern Number Theory, GTM 84, Springer, (1990).
3. Apostol, T.M., Introduction to Analytic number theory, UTM, Springer, (1976).
4. Niven I., Zuckerman, H.S. and Montgomery, H.L., An Introduction to the Theory of Numbers (5th ed.), John Wiley and Sons, Inc., (1991).

MA 325: Operator Theory (3:0)

Sz.-Nagy, Foias theory: Dilation of contractions on a Hilbert space, minimal isometric dilation, unitary dilation; von Neumann's inequality; Ando's theorem: simultaneous dilation of a pair of commuting contractions; Parrott's example of a triple of contractions which cannot be dilated simultaneously; creation operators on the full Fock space and the symmetric Fock space.
Operator spaces: Completely positive and completely bounded maps; endomorphisms. Towards dilation of completely positive maps.
Unbounded operators: Basic theory of unbounded self-adjoint operators.

Instructor: G. Misra

Suggested books:

1. Conway, J.B., A course in Functional Analysis, Springer, 1985.
2. Paulson, V., Completely Bounded Maps and Dilations, Pitman Research Notes, 1986.

MA 327: Topics in Analysis (3:0)

In this course we begin by stating many wonderful theorems in analysis and proceed to prove them one by one. In contrast to usual courses (where we learn techniques and see results as `applications' of those techniques), we take a somewhat experimental approach in stating the results and then exploring the techniques to prove them. The theorems themselves have the common feature that the statements are easy to understand but the proofs are non-trivial and instructive. And the techniques involve analysis.

We intend to cover a subset of the following theorems: isoperimetric inequality, infinitude of primes in arithmetic progressions, Weyl's equidistribution theorem on the circle, Shannon's source coding theorem, uncertainty principles including Heisenberg's, Wigner's law for eigenvalues of a random matrix, Picard's theorem on the range of an entire function, principal component analysis to reduce dimensionality of data...

Prerequisites: Real analysis, complex analysis, basic probability, linear algebra, groups. It would help to know or to concurrently take a course in measure theory and/or functional analysis.

Instructor: M. Krishnapur

Suggested books:

1. Korner, I. T. W., Fourier Analysis, Cambridge University Press, 1 ed., 1988.
2. Rudin, W., *Real and Complex Analysis*, Tata McGraw Hill Education, 3rd ed., 2007.
3. Thangavelu, S., An Introduction to the Uncertainty Principle, Birkhauser, 2003.
4. Serre, J. P., A Course in Arithmetic, Springer-Verlag, 1973.
5. Ash, R., Information Theory, Dover Special Priced Titles, 2008.

MA 338: Differentiable Manifolds and Lie Groups

Differentiable manifolds: Differentiable manifolds, differentiable maps and tangent spaces; regular values and Sard’s theorem; submersions and immersions; vector fields and flows; the exponential map; Frobenius’s Theorem; Lie groups, Lie algebras and the exponential map; homogeneous spaces; tensors and differential forms; the Lie derivative; orientable manifolds; integration on manifolds and Stokes’s Theorem.
Riemannian Geometry: Riemannian metrics, the Levi−Civita connection; curvature and parallel transport.
Instructor: H. Seshadri

Suggested books:

1. Kumaresan, S., A Course in Differential Geometry and Lie Groups, Texts and Readings in Mathematics, 22, Hindustan book Agency, 2002.
2. Warner, F., Foundations of Differentiable Manifolds and Lie Groups, Graduate Texts in Mathematics, 94, Springer-Verlag, 1983.

ELECTIVES OFFERED IN THE JANUARY-APRIL SEMESTER

MA 210: Logic, Types and Spaces (3:0)

This course is an introduction to logic and foundations from both a modern point of view (based on type theory and its relations to topology) as well as in the traditional formulation based on first-order logic.

Topics:

Basic type theory: Terms and types, function types, dependent types, inductive types.

First order logic: First order languages, deduction and truth, Models, Godel's completeness and compactness theorems. Godel's incompleteness theorem.

Homotopy Type Theory : Propositions as types, the identity type family, topological view of the identity type, foundations of homotopy type theory.

Most of the material will be developed using the dependently typed language/proof assistant Agda. Connections with programming in functional language will be explored.

Prerequisites: No prior knowledge of logic is assumed. Some background in algebra and topology will be assumed. It will be useful to have some familiarity with programming.

Instructor: S. Gadgil

Suggested books:

1. Homotopy Type Theory: Univalent Foundations of Mathematics, Institute for Adv. Studies, Princeton 2013, available at http://homotopypetheory.org/book/
2. Manin, Yu., I., *A Course in Mathematical Logic for Mathematicians*, second Edition, Graduate Texts in Mathematics, Springer-Verlag, 2010.
3. Srivastava, S. M., *A Course on Mathematical Logic,* Universitext, Springer-Verlag, 2008.

MA 213: Representation Theory of Finite Groups (3:0)

Representation theory: Representations of finite groups, irreducible representations, complete reducibility, Schur's lemma, characters, orthogonality, class functions, regular representations and induced representations, the group algebra.

Linear groups: Representations of the group SU_2.

Instructor: P. Singla

Suggested books:

1. Artin, M., Algebra, Prentice Hall of India, 1994.
2. Fulton W., and Harris, J., Representation Theory, Springer-Verlag, 1991.
3. Serre, J. P., Linear Representations of Finite Groups, Springer-Verlag, 1977.

MA 229: Calculus on Manifolds (3:0)

Functions of several variables, Directional derivatives and continuity, total derivative, mean value theorem for differentiable functions, Taylor's formula.

The inverse function and implicit function theorems, extreme of functions of several variables and Lagrange multipliers. Sard's theorem.

Integration on Euclidean spaces, Fubini's theorem, the change of variables formula and partitions of unity.

Manifolds: Definitions and examples. Vector fields and differential forms on manifolds. Stokes' theorem.

Instructor: A.K. Nandakumaran

Suggested books:

1. Spivak, M., Calculus on Manifolds, W.A. Benjamin Co., 1965.
2. Apostol, T.M., Mathematical Analysis, Narosa Pub. House, Indian Ed.
3. Munkres, J., Analysis on Manifolds.

MA 312: Commutative Algebra (3:0)

Rings and Ideals: Rings and ring homorphisms; Ideals; Quotient rings; operations on ideals; Prime and maximal ideals; Nilradical and Jacobson radical.
Modules: Modules and module homomorphisms, submodules and quotient modules; Operations on submodules, Direct sums and direct products, Finitely generated modules; Exact sequences; Tensor product of modules and its properties; Algebras; Tensor product of algebras.
Rings and Modules of Fractions: Local properties; Extended and contracted ideals in rings of fractions.
Chain conditions on Modules: Ascending and descending chain conditions on modules; Noetherian rings and modules; Artinian rings.
Primary Decomposition: Primary submodules; Primary decomposition for modules; Uniqueness of isolated primary components; Associated primes.
Integral Dependence: Integral dependence; The Going-up Theorem; Integrally-closed domains; The Going-down Theorem; Noether's normalization lemma.
Discrete valuation rings and Dedekind domains: Discrete valuation rings; Dedekind domains; Fractionary ideals.

Instructor: D. P. Patil

Suggested books:

1. Atiyah, M.F. and Macdonald, I.G., Introduction to Algebra, Addison-Wesley, 1969.
2. Matsumura, H., Commutative Algebra, W. A. Benjamin Co., New York, 1970.
3. Raghavan, S, Singh, B and Sridharan, R., Homological Methods in Commutative Algebra, TIFR Mathematical Pamphlet Number 5, Oxford University Press, 1977.
4. Serre, J.P., Local Algebra (translated from French), Springer Monographs in Mathematics, Springer-Verlag, 2000.
5. Zariski, O., and Samuel, P., Commutative Algebra, Vols I & II, Van Nostrand, 1958 and 1960.

MA 315: Galois Theory (3:0)

Review of Groups: Groups actions, composition series, Jordan-Holder theorem, solvable groups.
Review of Rings: Polynomial rings, zeroes of polynomials, elementary symmetric functions and the Fundamental Theorem on Symmetric Functions. Resultants and discriminants, Euclidean rings, principal ideal domains and factorial rings, factorization in polynomial rings.
Field theory: Finite fields, finite and algebraic extensions. Algebraic closure, algebraically closed fields. The proof of the Fundamental Theorem of Algebra. Separable polynomials and separable extensions, splitting fields, normal extensions, Galois extensions, the Galois

group of a polynomial. The Fundamental Theorem of Galois Theory, radical extensions, solvability by radicals, computation of Galois groups.

Instructor: A. Banerjee

Suggested books:

1. Artin, E., Galois Theory, University of Notre Dame Press, 1944.
2. Artin, M., Algebra, Prentice-Hall, 1994.
3. Jacobson, N., Lectures in Abstract Algebra, Vols. I, II & III, D. Van Nostrand Co. Inc., Princeton, New Jersey, 1966.
4. Lang, S., Algebra, Graduate Texts in Mathematics, Vol. 211, Springer-Verlag, 2002.
5. Weber, H., Lehrbuch der Algebra, Band I, II, III, Braunschweug 1898, 1899, 1908.

MA 318: Combinatorics (3:0)

Counting problems in sets, multisets, permutations, partitions, trees, tableaux; ordinary and exponential generating functions; posets and principle of inclusion-exclusion, the transfer matrix method; the exponential formula, Polya theory; bijections, combinatorial identities and the WZ method.

Instructor: A. Ayyer

Suggested books:

1. Stanley, R., Enumerative Combinatorics, Vol. 1, Second edition, 2011, Cambridge University Press.
2. Wilf, H., Generating Functionology, 3rd edition, 2005, A. K. Peters/CRC Press.
3. Stanton, D. and White, D., Constructive Combinatorics, Springer, 1986.
4. Erickson, M.J., Introduction to Combinatorics.

MA 347: Advanced PDE and Finite Element Method (3:0)

Distribution Theory: Introduction, Topology of Test functions, Convolutions, Schwartz Space, Tempered Distributions, Fourier Transform; **Sobolev Spaces :** Definitions, Extension Operators, Continuous and Compact Imbeddings, Trace results; **Weak Solutions :** Variational formuation of Elliptic Boundary Value Problems, Weak solutions, Maximum Principle, Regularity results; **Finite Element Method (FEM) :** Introduction to FEM, Finite element solution of Elliptic boundary value problems.

Instructor: T. Gudi

Suggested books:

1. Schwartz, L., Theories des Distributions, Hermann, (1966).
2. Kesavan, S., Topics in Functional Analysis and Applications, John Wiley & Sons (1989).
3. Clarlet, P.G., Lectures on Finite Element Method, TIFR Lecture Notes Series, Bombay (1975).
4. Marti, J.T., Introduction to Finite Element Method and Finite Element Solution of Elliptic Boundary Value Problems, Academic Press (1986).

MA 361: Probability Theory

Probability measures and random variables, pi and lambda systems, expectation, moment generating function, characteristic function, laws of large numbers, limit theorems, conditional contribution and expectation, martingales, infinitely divisible laws and stable laws.

Instructor: M. Krishnapur

Suggested books:

1. Durrett, R., Probability Theory and Examples, 4th Edition, Cambridge University Press, 2010.
2. Billingsley, P., Probability and Measure, 3rd Edition, Wiley India.
3. Killenberg, O., Foundations of Modern Probability, 2nd Edition, Springer-Verlag.