

SYLLABUS

f or

MPhi I . MATHEMATICS

**(For students admitted from 2015–2016
onwards)**

Semester	Subject Code	Title of the Paper	Hours/Week	No. of Credits	Medium of instruction
I	RR1MMA1	Research Methodology	6	4	English

UNIT I: Method and technique: Introduction – Defining the research problem –Research design.

UNIT II: Assignment and At the tertiary level writing at the tertiary level - Planning the assignment - Planning the Thesis – Scholarly writing.

UNIT III: Writing the Thesis: General format-Tables and figures- Referencing.

UNIT IV: Introduction – Bibliographies and catalogues – Journals for the history of Mathematics- Books and editions –Libraries and catalogues – Manuscripts and Archives Societies – the open.

UNIT V: Trends in IT: Evaluation of internet- Basic Network- Basic internet terms – Getting connected to internet- Internet tools: Web Browser –Browsing using IE – E mail – Search engines- Instant-Messaging -Emerging trends in Information Technology - e- commerce – EDI- Mobile communication – Blue tooth – GPS – Infrared communication –smart card – Immanent Technologies.

Text Books

1. Research Methodology, C R. Kotahri
Unit I: Chapter 1,2 and 3
2. Thesis and Assignment writing, Janarthan Anderson and others-Willy Eastern Ltd,1970.
Unit II: Part 1, sections (1 to 4)
Unit III: Part 2, sections (5 to 10) Chapter 4 History of Mathematics
3. Use of mathematical Literature-A.R.Darling –Butter worth’s and Co London, 1977.
Unit IV : Chapter 5 (page no.60 to 75)
4. Introduction to information Technology,ITL Education Solution Ltd.Pearson Education 2006
Unit V: Chapter 15,16 and 21

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No. of Credits	Medium of instruction
I	RR1MMA2	Algebra and Topology	6	4	English

Algebra

UNIT I: Modules : Basic definition – The group of homomorphism – Direct Products and Sums of Modules – Free Modules – Vector space – the Dual Space .

UNIT II: Noetherian Ring and Modules : Basic Criteria – Hilberts Theorem – Power Series – Association Primes – Primary Decomposition .

Topology

UNIT III: Spaces and Maps: Sum and product of spaces –Identification and quotient spaces – Homotopy and isotopy.

UNIT IV: Spaces of Maps: The space $\text{Map}(X, Y)$ – Admissible topologies-Maps on topological products- Injection and Projections – Topology of Uniform convergence.

UNIT V: Fundamental Groups: Equivalence classes of paths – Groupoids – Fundamental Groupoids – Induced homomorphisms - Fundamental groups of spheres - Higher homotopy groups.

Text Books

1. Algebra, Serge Lang, Addison Wesley Publishing Company, London, 1965.

Unit I: Chapter 3(Sec 1 to 3)

Unit II: Chapter 4 (Sec 1 to 5)

2. Elements of General Topology, Sze-Tsen Hu, Holden – Day, Inc

Unit III: Chapter 2(sec 5 to 7)

Unit IV: Chapter 5(sec 1 to 5)

Unit V: Chapter 6(sec 1 to 6)

Reference

1. Topics in Algebra, I. N . Herstein, John Wiley & Sons, 2nd Edition.

2. Introduction to General Topology, George L. Cain, Addison – Wesley Publishing Company.

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Semester	Subject Code	Title of the Paper	Hours/Week	No. of Credits	Medium of instruction
I	RR1MMA3	Stochastic Processes and Graph Theory	6	4	English

Stochastic Processes

UNIT I: Renewal processes and Theory- Renewal Process- renewal processes in Continuous Time - renewal equation - stopping Time : Wald's Equation – renewal Theorem.

UNIT II: Renewal processes and Theory- Renewal Process- Delayed and equilibrium Renewal processes - Residual and Excess Lifetimes - renewal reward Process- Alternating Renewal process - Regenerative Stochastic Processes : Existence of Limits – Regenerative Inventory System.

UNIT III: Branching Processes – properties of Generating Functions of Branching Processes – Probability of extinction – Distribution of the Total Number of Progeny – conditional limit Laws- generalisations of the Classical Galton –Watson Process.

Graph Theory

UNIT IV: Trees and Distance: Basic properties – Distance in Trees and Graphs. Spanning Trees and Enumeration: Enumeration of Trees Spanning Trees in Graphs – Decomposition and Graceful labeling.

UNIT V: Edges and Cycles: Line Graph and Edge Coloring. Edge coloring- Hamiltonian Cycles- Necessary conditions-Sufficient condition – Planarity Coloring and Cycles : Tait's theorem – Grinberg's theorem.

Text Books

- Stochastic Processes, J. Medhi, New Age International Publishers, New Delhi, - Second Edition.
Unit I: Chapter 6(Sec 6.1 to 6.5) Unit II: Chapter 6 (Sec 6.6 to 6.11)
Unit III: Chapter 9 (Sec 9.1 to 9.6)
- Introduction to Graph Theory, Douglas B. West , PHI Learning Private Limited, New Delhi.
Unit IV: Chapter 2(Optimization, trees and optional topics are excluded)
Unit V: Chapter 7 (Optional topics are excluded)

Reference

- Probability and Stochastic processes with Applications, Oliver Knill, Overseas Press, 2009.
- Theory and problems of Graph Theory, V.K. Balakrishnan, Schaum's outline series, Mc Graw Hill, New Delhi.

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No. of Credits	Medium of instruction
I	RR1MMA4A	Methods of Manpower Planning	6	4	English

UNIT I: Properties of Expectation: Expectation of Sums of random variable – Covariance, Variance of Sums and Correlations – Conditional expectation – Moment generating functions.

UNIT II: Discrete Distributions: Standard forms – Moments and Chief properties of all discrete distributions.

UNIT III: Continuous Distributions: Standard forms – Moments and Chief properties of all continuous distributions.

UNIT IV: Methods for finding Laplace Transforms and Laplace Inverses: Laplace transforms – Laplace inverses and Laplace – Stieltjes transform – Distributions and Calculation of raw moments.

UNIT V: Non – Linear Programming – Unconstrained Optimization Techniques: Indirect Search (Descent) methods – Steepest Descent (Cauchy) method – Conjugate gradient (Fletcher – Reeves) method – Newton’s method – Quasi – Newton’s method – Davidon – Fletcher – Powell method – Broyden – Fletcher – Goldfarb – Shanno method .

Text Books

1. A first Course in Probability, Sheldon M.Ross, Dorling Kindersley (India) Pvt . Ltd., 6th Edition (2004).
Unit I: Chapter 7 (Sec 7.2 – 7.6)
Unit II: Chapter 4 (Sec 4.6 – 4.9)
Unit III: Chapter 5 (Sec 5.2 – 5.7)
2. Stochastic Processes, J . Medhi, Wiley Eastern ., 2nd Edition (2004)
Unit IV: Chapter 1 (Sec 1.2 – 1.3)
3. Engineering Optimization Theory and Practice, Singiresu S. Rao, New Age International Pvt. Ltd ., 3rd Edition (2003).
Unit V: Chapter 6 (Sec 6.10 – 6.17)

Reference

Probability and Stochastic processes with Applications, Oliver Knill, overseas press - 2009.

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No.of Credits	Medium of instruction
I	RR1MMA4B	Modern Topology	6	4	English

UNIT I: Sequences- Sequences and Compact Spaces- Nets.

UNIT II: Complete Pseudometric Spaces: Cauchy Sequences and Complete Spaces - Baire Category Theorem – uniform Continuity – Completion of a pseudometric Space – Banach Fixed Point Theorem.

UNIT III: Euclidean Spaces: Euclidean n- spaces – Space-Filling Curves - Pseudonorms – Spheres.

UNIT IV: Hyperspaces and Multifunctions: Hyperspaces – Quotient Spaces and Hyperspaces – The Hausdorff Metric – Multifunctions – Functions Induced by Multifunctions.

UNIT V: Dimension: Topological Dimension – Dimension of Subspaces – Dimension in R^n – Hausdorff Dimension.

Text Book

Introduction to General Topology, George L. Cain, Addison – Wesley Publishing Company

Unit I: Chapter 7 (section 7.1 to 7.3)

Unit II: Chapter 8 (section 8.1 to 8.5)

Unit III: Chapter 9 (section 9.1 to 9.4)

Unit IV: Chapter 11 (section 11.1 to 11.5)

Unit V: Chapter 12 (section 12.1 to 12.4)

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No.of Credits	Medium of instruction
I	RR1MMA4C	Advanced Graph Theory	6	4	English

UNIT I: Matchings – System of Distinct Representatives and Marriage Problem – Covering

–
1 – Factor – Stable Matchings.

UNIT II: Independence: Independence and Covering - Edge colouring – Vizing’s Theorem -Vertex colouring – uniquely colourable Graphs- critical Graphs.

UNIT III: Planar Graphs: Planar Embedding - Euler’s Formula – Maximal Planar Graphs – Geometric Dual – Characterisations of Planar Graphs.

UNIT IV: Labelings: Predecessor and Successor – Algorithm – Graceful labeling – Sequential Functions – Application- Magic graphs – Conservative graphs.

UNIT V: Domination: Domination Number –Minimal Dominating Sets – Independent Dominating Sets – Bounds for the Domination Number – Global Dominating Sets – Total Domination – Connected Domination.

Text Book

Topics in Graph Theory and Algorithms, M.Murugan, Muthali Publishing House, Chennai.

Unit I: Chapter 6 (section 6.1 – 6.5)

Unit II: Chapter 7 (section 7.1, 7.2, 7.4 – 7.7)

Unit III: Chapter 8 (section 8.1 – 8.5)

Unit IV: Chapter 10 (section 10.1 – 10.7)

Unit V: Chapter 11 (section 11.1 – 11.7)

Reference

Introduction to Graph Theory, Douglas B. West , PHI Learning Private Limited, New Delhi.

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No.of Credits	Medium of instruction
I	RR1MMA4D	Modern Stochastic Processes	6	4	English

UNIT I: Discrete Stochastic Processes - Conditional Expectation-Martingales - Doob's convergence theorem-L'evy's upward and downward theorems - Doob's decomposition of a stochastic process - Doob's submartingale inequality - Doob's L^p inequality.

UNIT II: Discrete Stochastic Processes - Random walks - The arc-sin law for the 1D random walk -The random walk on the free group -The free Laplacian on a discrete group - A discrete Feynman-Kac formula – Discrete Dirichlet problem - Markov processes.

UNIT III: Continuous Stochastic Processes - Brownian motion - Some properties of Brownian motion - The Wiener measure - L'evy's modulus of continuity - Stopping times - Continuous time martingales - Doob inequalities - Khintchine's law of the iterated logarithm- The theorem of Dynkin-Hunt - Self-intersection of Brownian motion - Recurrence of Brownian motion.

UNIT IV : Continuous Stochastic Processes - Feynman-Kac formula - The quantum mechanical oscillator - Feynman-Kac for the oscillator - Neighborhood of Brownian motion - The Ito integral for Brownian motion - Processes of bounded quadratic variation - The Ito integral for martingales - Stochastic differential equations.

UNIT V : Selected Topics - Percolation - Random Jacobi matrices - Estimation theory - Vlasov dynamics - Multidimensional distributions - Poisson processes - Random maps - Circular random variables -Lattice points near Brownian paths - Arithmetic random variables.

Text Book

Probability and Stochastic processes with Applications, Oliver Knill, Overseas Press, 2009.

Unit I: Chapter 3 (section 3.1 -3.7)

Unit II: Chapter 3 (section 3.8 – 3.14)

Unit III: Chapter 4 (section 4.1 – 4.11)

Unit IV: Chapter 4 (section 4.1 – 4.19)

Unit V: Chapter 5 (section 5.1 – 5.10)

Reference

Stochastic Processes, J. Medhi, New Age International Publishers, New Delhi, - Second Edition.

Question Paper Pattern

Maximum Marks: 60

Examination Duration: 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours/Week	No.of Credits	Medium of instruction
I	RR1MMA4E	Advanced Stochastic Processes	6	4	English

UNIT I: Limit Theorems – Probability spaces, random variables, independence – Kollmogorove’s 0 – 1 law, Borel cantelli lemma - Integration, Expectation, variance - Results form real analysis - some inequalities - The weak law of large numbers - The probability distribution function - Convergence of random variables– The strong law of large numbers.

UNIT II: Limit Theorems - Birkhoff’s Ergodic theorem - More convergence results - Classes of random variables – Weak convergence - The central limit theorem - entropy of distributions - Markov operators - Characteristic functions - The law of the iterated logarithm

UNIT III: Discrete Stochastic Processes - Conditional Expectation-Martingales - Doob’s convergence theorem- L’evy’s upward and downward theorems - Doob’s decomposition of a stochastic process - Doob’s submartingale inequality - Doob’s L^p inequality

UNIT IV: Discrete Stochastic Processes - Random walks - The arc-sin law for the 1D random walk -The random walk on the free group -The free Laplacian on a discrete group - A discrete Feynman-Kac formula – Discrete Dirichlet problem - Markov processes

UNIT V: Continuous Stochastic Processes - Brownian motion - Some properties of Brownian motion - The Wiener measure - L’evy’s modulus of continuity - Stopping times - Continuous time martingales - Doob inequalities - Khintchine’s law of the iterated logarithm- The theorem of Dynkin-Hunt - Self-intersection of Brownian motion - Recurrence of Brownian motion

Text Book

Probability and Stochastic processes with Applications, Oliver Knill, overseas press - 2009.

Unit I: Chapter 2 (Sec 2.1 - 2.9) Unit II: Chapter 2 (Sec 2.10 - 2.18)

Unit III: Chapter 3 (Sec 3.1 - 3.7) Unit IV: Chapter 3 (Sec 3.8 - 3.14)

Unit V: Chapter 4 (Sec 4.1 - 4.11)

Reference

Stochastic Processes, J. Medhi, New Age International Publishers, New Delhi, Second Edition.

Question Paper Pattern

Maximum Marks: 60

Examination Duration : 3 Hours

Part A: $5 \times 6 = 30$ (Either/Or type – One question from each unit)

Part B: $3 \times 10 = 30$ (Three out of Five – One question from each unit)

Signature of the HOD