(For students admitted from 2015-2016 onwards)

SYLLABUS

for

M.Sc. MATHEMATICS

(For students admitted from 2015-2016 onwards)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	RR1PMA1	Modern Algebra	6	5	English

UNIT I: Group Theory: Sylow's Theorem – Direct Products – Finite Abelian Groups.

UNIT II: Ring Theory: Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings Over Commutative Rings. Vector Spaces and Modules: Modules.

UNIT III: Fields: Extension Fields – Roots of Polynomials – More about Roots.

UNIT IV: Fields: The Elements of Galois Theory - Selected Topics: Finite Fields.

UNIT V: Linear Transformations: The Algebra of Linear Transformations – Hermitian, Unitary and Normal Transformations – Real Quadratic Forms.

Text Book

Topics in Algebra, I. N . Herstein, John Wiley & Sons, 2^{nd} Edition.

UNIT I : Chapter 2 (Sec 2.12 – 2.14)

UNIT II : Chapter 3(Sec 3.9 – 3.11) & Chapter 4 (Sec 4.5)

UNIT III : Chapter 5 (Sec 5.1 , 5.3 , 5.5)

UNIT IV : Chapter 5 (Sec 5.6) & Chapter 7(Sec 7.1)

UNIT V : Chapter 6 (Sec 6.1 , 6.10 , 6.11)

Reference

Algebra, S. Lang, 3rd Edition, Springer (India), 2004.

Question Paper Pattern

Maximum Marks: 75 Examination Duration : 3 Hours

Part A :$10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	RR1PMA2	Real Analysis	6	5	English

UNIT I : Basic Topology – Finite, Countable and Uncountable sets –Metric spaces – Neighborhood – Open sets –Closed sets –Compact sets –Perfect sets - the Cantor set – Connected sets.

UNIT II : Continuity - Limits of functions – continuous functions – Continuity and Compactness –Continuity and Connectedness – Discontinuities –Monotonic functions.

UNIT III: Differentiation - The Derivatives of a Real function – Mean Value theorems – The Continuity of Derivatives- L'Hospital's Rule – Derivatives of Higher Order – Taylor's theorem – Differentiation of vector valued functions.

UNIT IV: Riemann - Steiljels Integral - Definition and Existence of Riemann - Stejiels Integral –Properties of the Integral-Integration and Differentiation – Integration of vector valued functions – Rectifiable curve.

UNIT V: Sequence and series of functions: Discussion of Main Problem – Uniform Convergence-Uniform Convergence and Continuity - Uniform Convergence and Integration-Uniform Convergence and Differentiation – Equicontinuous family of functions –The Stone-Weierstrass theorem.

Text Book

Walter Rudin, Principles of Mathematical Analysis, McGraw –Hill International Book Company, New York, Third Edition,

UNIT I: Chapter 2(sec 2.1 - 2.47) **UNIT II:** Chapter 4(sec 4.1 – 4.30)

UNIT III: Chapter 5(sec 5.1 – 5.19) **UNIT IV:** Chapter 6(sec 6.1 – 6.27)

UNIT V: Chapter 7(sec 7.1 – 7.26)

Reference

1. Mathematical Analysis, Tom Apostol, Adddison–wesley Publishing company, London,1971.

2. Methods of Real Analysis, R. Goldberg, Oxford & IBH Publishing company.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	RR1PMA3	Programming in C^{++} and Introduction to LATEX	6	5	English

UNIT I: Beginning with C^{++} - Applications of C^{++} - Simple programs – Structure of C^{++} program – creating the source file – compiling and linking – tokens: Expressions and control structures – Keywords – identifiers – Basic data types – User defined data types – derived data types.

UNIT II: Declaration of variables – reference variable – Operation in C^{++} - Manipulators – Type cast Operator – Expressions and Implicit conversions – Operator overloading Operator precedence – Control structures.

UNIT III: Functions in C^{++} - Introduction – main function – Functions prototyping – Call by reference – Return by reference – In line function – Default arguments – Constant arguments – Function over Loading – Friend and virtual functions.

UNIT IV: LATEX: Introduction – What is Latex? – Simple typesetting – Fonts – Type size – The document – Page style – page numbering – Formatting length – Parts of a document – Dividing the document – Bibliography.

UNIT V: Typesetting Mathematics – Basics – Custom commands – More on Mathematics – Typesetting theorems – Theorems typing in Latex – Designer theorems.

Text Books

1. Object Oriented Programming with C^{++}, E. Balagurusamy, Tata McGraw – Hill Publishing Company Ltd., New Delhi.(1995)

UNIT I: Chapter 2 (sec 2.1 – 2.8) & Chapter 3 (sec 3.1 – 3.7)

UNIT II: Chapter 3 (sec 3.13 – 3.24)

UNIT III: Chapter 4 (sec 4.1 – 4.10)

2. LATEX Tutorials, A PRIMER Indian TEX Users Group, Trivandrum, India (2003).

UNIT IV: Tutorial I & II and Tutorial III(Section III.1)

UNIT V: Tutorial VIII (Section VIII.1-VIII.3) & Tutorial IX (Section IX.1 & IX.2)

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	RR1PMA3P	Practical in C++ and Latex	6	5	English

1. Write a function in C++ to generate a Fibonacci Series of 'n' Number.
2. Develop a program in C++ for finding the largest of any three given numbers using Macro Definition.
3. How to find the nC_r value which returns the factorial of a given number using the function call in the expression?
4. Develop an object oriented program in C++ to create a database of the following items of the derived class: Ward number, Name of the patient, Sex, Age, Bed Number, Nature of the illness and Date of admission. Design a base class 1, base class 2 and virtual class.
5. Write a program in C++ structure keyword to create a primitive simple bank customer object like Pin Number, Account Number, Type of account, Name of the Depositor, Current Balance and Available Balance.
6. Write a program in C++ using function overloading to read two matrices of different data such as integers and floating –point numbers. Find out the sum of the above two matrices separately and display the total sum of these arrays individually.
7. Write an object – oriented program in C++ to read an integer number and find the sum of the all digits until it reduces to a single digit using constructor, destructor, default constructor and inline member functions.
8. Develop a program in C++ to add two complex numbers and display all the three number.
9. Use operator overloading write a program in C++ to demonstrate function by students result.
10. Create a Latex document for the given Mathematical Expression.
11. Create a Latex document that contains the following: Title – Author's name – Abstract – Introduction – Sections – Tables and Bibliography.
12. Construct a Latex document using sums, integrals and limits.

Question Paper Pattern

Maximum Marks: 60 Examination Duration: 3 Hours

Observation Note : 10 $Marks$

Record Note : 20 $Marks$

Algorithm, Program and Result : 30 $Marks$

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	RR1PMAEL1	Graph Theory	6	4	English

UNIT I: Graphs: Basic concepts - Paths and connectedness - Automorphism of a simple graph - Line graphs – Operations on graphs.

UNIT II: Directed graphs: Basic concepts – Tournaments connectivity : vertex cuts and Edge cuts – Connectivity and Edge - connectivity – Blocks.

UNIT III: Independent sets and Matchings : Vertex independent sets and vertex coverings – Edge-Independent sets – Matchings and Factors – Eulerian Graphs – Hamiltonian Graphs.

UNIT IV: Graph colorings: Vertex colorings of graphs – critical graphs – Edge coloring of graphs – Chromatic Polynomials.

UNIT V: Planarity: Planar and Nonplanar graphs – Euler formula and its consequences - k_5 and $k_{3,3}$ are Nonplanar Graphs – Dual of a Plane Graph – the Four – Color Theorem and the Heawood Five – Color Theorem – Hamiltonian Plane graphs.

Text Book

A Text Book of Graph Theory, R. Balakrishnan and K. Ranganathan, Springer, New Delhi.
UNIT I: Chapter 1 (Sec 1.4- 1.7)

UNIT II: Chapter 2 (Sec 2.1, 2.2) & Chapter 3(Sec 3.1 - 3.3)

UNIT III: Chapter 5 (Sec 5.1 - 5.3) & Chapter 6(Sec 6.1, 6.2)

UNIT IV: Chapter 7 (Sec 7.1 , 7.2 , 7.4 , 7.7)

UNIT V: Chapter 8 (Sec 8.1- 8.5 , 8.7)

Reference

1. Graph Theory with Applications, J . A . Bondy and U .S . R . Murty, Springer (2002).
2. Theory and Problems of Graph Theory, V. K . Balakrishnan, Schaum's outlines series , McGra Hill , New Delhi.

Question Paper Pattern

Maximum Marks : 75 Examination Duration : 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	RR2PMA4	Modern Probability Theory	6	5	English

Unit I: Basic Principle of Continue – Permutations – Combinations – Multinomial Coefficients – Distribution of Balls in Urns – sample space and events-axioms of probability - some simple propositions- equally likely outcomes - continuity of the probability as a set function.

Unit II: Conditional probabilities - Baye's formula – independent events – random variables – distribution functions – Bernoulli, Binomial and Poisson random variables - Discrete probability distributions: Geometric Negative Binomial and Hyper Geometric random variables – Zeta distribution.

Unit III: Continuous random variables – the Uniform and normal random variables – exponential random variables – continuous distributions: the distribution of a function of a random variable - Joint distribution functions - Independent random variables – Their sums – Conditional distributions – discrete case and Continuous Case -order statistics - Joint probability distribution functions of a random variables.

Unit IV: Expectation – Function of a random variable - sums of random variables - variance - covariance – conditional expectation and prediction. – Moment Generating Functions – General Definition of Expectation.

Unit V: Limit theorems - Chebyshev's inequality - weak law of large numbers – central limit theorems – the strong law of large numbers – other inequalities - Additional Topics in Probability- The Poisson Process – Markov Chains – Surprise, Uncertainty and entropy.

Text Book

A first course in Probability, Sheldon Ross, Maxwell MacMillan International edition, Third edition, New York (1989).

UNIT I: Chapters 1 and 2 (full) **UNIT II:** Chapter 3 and 4 (full)
UNIT III: Chapter 5 and 6 (full) **UNIT IV:** Chapter 7 (full)
UNIT V: Chapter 8 (full) & Chapter 11(Sec 1-3)

Reference

Probability- An Introduction, Geoffery Grimmel and Domenic Welsh,Oxford University press (1986).

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	RR2PMA5	Differential Equations	6	5	English

UNIT I: The general solution of homogeneous equation – the use of known solution to find another – the method of variation of parameter – power series solutions.

UNIT II: Regular singular points – Gauss's hyper geometric equation – the point at infinity – Legendre polynomial – Bessel function – properties of Legendre polynomials.

UNIT III: Ordinary differential equation in more than two variables – linear first order partial differential equation – integral surfaces passing through a given curve – surface orthogonal to a given system of surfaces.

UNIT IV: Compatibility systems of first order partial differential equation – Charpit's method – Jacobi's method.

UNIT V: Partial differential equation of the second order with constant coefficients - linear equations with variable coefficients.

Text Books

1. Differential Equations with Applications and Historical Notes, G.F. Simmons, Tata McGraw Hill,NewDelhi, 1984.

UNIT I: Chapter 3(Sec 15, 16, 19) & Chapter 5(Sec 26, 27)
UNIT II: Chapter 5 (Sec. 28 - 31) & Chapter 8 (Sec 45 - 47)

2. Elements of Partial Differential Equations, Ian Sneddon, Tata McGraw Hill,NewDelhi, 1984.

UNIT III: Chapter 1(Sec 3- 6) & Chapter 2 (Sec.4 - 6)
UNIT IV: Chapter 2 (Sec 9,10,13)
UNIT V: Chapter 3 (Sec 4, 5)

Reference

An introduction to ordinary differential equations, E.A. Coddington, Englewood Cliffs,

EUA : Prentice-Hall 1961.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	RR2PMA6	Topology	6	5	English

UNIT I: Topological Spaces : Definition – Examples – Basis for a topology – The Order topology – The Product topology – The Order topology – The Product topology on $X \times Y$ – the Subspace topology – Closed sets and limit points.

UNIT II: Continuous functions- the Product topology-Definition – the metric topology – complete metric spaces.

UNIT III: Connectedness and Compactness: Connected spaces – Connected sets in the real line – Components and path components and – Local connectedness - Compact spaces.

UNIT IV: Countability and Separation axioms: The countability axioms – The Separation axioms – The Urysohn's lemma – Tietze extension theorem – Completely regular spaces.

UNIT V: Paracompactness and Homotopy of paths: Local fixedness – Paracompactness – Homotopy of paths – The fundamental group.

Text Book

James R . Munkres, Topology, A first course, Prentice – Hall of India Pvt Ltd, 1991.

UNIT I: Chapter 2(Sec 2.1 - 2.6)

UNIT II: Chapter 2 (Sec 2.7 - 2.10) & Chapter 7 (Sec 7.1)

UNIT III: Chapter 3 (Sec 3.1 - 3.5)

UNIT IV: Chapter 4 (Sec 4.1 to 4.3) & Chapter 5(Sec 5.2)

UNIT V: Chapter 6 (Sec 6.1, 6.4) & Chapter 8 (Sec 8.1, 8.2)

Reference

1. Counter examples in Topology, L. A. Steen and J .A . Seebach, Holt, Rinehart & Winston, Inc., New York , 1970 .

2. General Topology, S. Willard, Addison–Wesley Publishing Company, Inc Reading, Mass, 1970.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	RR2PMA7	Complex Analysis	6	5	English

UNIT I: Arcs and Closed Curves – Analytic Functions in regions – Conformal Mappings – Elementary Riemann Surfaces – Line integrals – Rectifiable arcs – Line integrals as Functions of arcs – Cauchy's theorem for rectangle – Cauchy's theorem in disk.

UNIT II: The index of a point with Respect to Closed Curve – The integral Formula – Higher Derivatives – Morera's Theorems – Liouvelle's Theorem – Cauchy's Estimates – Fundamental Theorem of Algebra – Local properties of analytical functions – Removable Singularities – Taylor's Theorem – Zeros and Poles – Meromorphic Function – Essential Singularities – The Local Mapping – The Maximum Principle .

UNIT III: The General form of Cauchy's Theorem – Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem and its Proof – Locally Exact differentials – Multiply Connected Regions – The Residue Theorem – Argument Principle – Evaluation of definite integrals .

UNIT IV: Harmonic Functions – Definitions and Basic Properties – Polar form Mean Value Property – Poisson's Formula – Schwartz's Theorem – Reflection Principle – Weierstrass Theorem - The Taylor's series – Laurent's series .

UNIT V: Partial Fractions – Infinite Products – Canonical Products – Entire functions – Representation of entire functions – Formula for sinz– Gamma function – Jensen's formula.

Text Book

Complex Analysis, Lars V. Ahlfors, Third Edition, McGraw Hill International, 1979.

UNIT I: Chapter 3(Sec 2.1 -2.3) & Chapter 4 (Sec 1.1 - 1.5)
UNIT II: Chapter 4 (Sec 2.1 - 2.3, 3.1 - 3.4) **UNIT III:** Chapter 4 (Sec 4.1 - 4.7, 5.1 - 5.3)
UNIT IV: Chapter 4 (Sec 6.1 - 6.5) & Chapter 5(Sec 1.1 - 1.3)
UNIT V: Chapter 5 (Sec 2.1 - 2.4, 3.1)

Reference

Functions of One Complex Variable, J.B. Conway, Narosa Publishing House, second Edition.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	RR2PMAEL2	Advanced Numerical Analysis	6	4	English

UNIT I: Iteration methods based on a second degree Equations - Muller method – Chebyshev method – Polynomial Equations - Birge-Vieta method – Bairstow method – Graffe's root Squaring method .

UNIT II: System of Linear Algebraic Equations and Eigen value problems - Direct method – Triangularization method – Cholesky method – Partition method – Iteration methods: Jacobi iteration method – Gauss- Seidal iteration method – Successive Over Relaxation (SOR) method – Eigen values and Eigen vectors – Jacobi method for symmetric matrices – Given method for symmetric matrices – Power method .

UNIT III: Interpolation and Approximation - Hermite interpolation – Piecewise and Spline interpolation . Bivariate interpolation – Lagrange Bivariate interpolation – Newton's bivariate interpolation for equispaced points Least squares approximation - Gram-Schmidt Orthoganalization process.

UNIT IV: Numerical Differentiation - Method based on interpolation – Methods based on finite differences - Optimum choice of step – Length – Extrapolation methods – Partial differential equations . Numerical integration - Methods based on undetermined coefficients - Lobatto integration method – Radau integration method – Romberg integration - Double integration: Trapezoidal method – Simpson's method.

UNIT V: Ordinary Differential Equations: Numerical methods - Implicit Runge Kutta Method – Multistep methods - Adams Bashforth methods – Nystrom method – Adams – Moulton methods - Convergence of multistep methods – Numeror Predictor – corrector method.

Text Book

Advanced Numerical Methods, M.K.Jain, S.R.K.Iyengar, R.K.Jain, New Age International Limited Publishers by 2009. (Fifth Edition)

UNIT I: Chapter 2 (Sec 2.4 - 2.9) **UNIT II:** Chapter 3 (Sec 3.2 – 3.5, 3.7, 3.8, 3.11)
UNIT III: Chapter 4 (Sec 4.5 – 4.7, 4.9) **UNIT IV:** Chapter 5 (Sec 5.2 – 5.6, 5.8, 5.10, 5.11)
UNIT V: Chapter 6 (Sec 6.3, 6.6, 6.7)

Reference

Numerical Methods for Engineers, S.C. Chapra, and P.C. Raymond, Tata McGraw Hill, New Delhi (2000).

Question Paper Pattern

Maximum Marks : 75 Examination Duration : 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	RR3PMA8	Classical Dynamics	6	5	English

UNIT I: Introductory Concepts – Generalized Co-ordinates – Constraints – Virtual Work – Energy and Momentum.

UNIT II: Lagrange's equations – Derivation of Lagrange's Equation – Integral of Motion.

UNIT III: Small application of Lagrange's equation – Rayleigh's dissipation function- Impulsive Motion – Gyroscopic System – Velocity Dependable Potential.

UNIT IV: Hamilton's Equations - Hamilton's principle - Hamilton's equations- Other Variational Principles.

UNIT V: Hamilton - Jacoby theory- Hamilton's principle function - The Hamilton Jacobi equation - Separability.

Text Book

Scope and Treatment as in Classical Dynamics, Donald T. Greenwood, PHI Pvt. Ltd., New Delhi, 1985.

UNIT I: Chapter I (Sec 1.2 -1.5) **UNIT II:** Chapter II (Sec 2.1 -2.3)

UNIT III: Chapter III (Sec 3.1 - 3.4) **UNIT IV:** Chapter IV (Sec 4.1 - 4.3)

UNIT V: Chapter V (Sec 5.1 -5.3)

Reference

Classical Mechanics (2nd edition), H. Goldstein, Narosa Publishing House, NewDelhi.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	RR3PMA9	Measure Theory and Integration	6	5	English

UNIT I: Measure on the Real Line : Lebesque outer measure – measurable sets – Regularity – Measurable functions, Borel and Lebesque Measurabily**.**

UNIT II: Abstract measure spaces : Measures and outer measure – Completion of a measure – measure spaces – Integration with respect to a measure.

UNIT III: Inequalities and the L^P spaces: TheL^P spaces- Convex functions – Jensan's inequqlity – Inequalities of Holder and Minkowski – Completeness of $L^P(\mu)$.

UNIT IV: Signed measures and their derivatives: Singned measures and the Hahn decomposition – the Jordan decomposition – The Radon – Nikodym Thorem.

UNIT V: Some applications of the Radon – Nikodym theorem – Measurability in product space – the product measure and Fubini's Theorem.

Text Book

Measure Theory and Integration, G. De Barra, Addition- Wesley publishing company (1971).

UNIT I: Chapter 2 (Sec 2.1 - 2.5) **UNIT II:** Chapter 5 (Sec 5.1 - 5.6)

UNIT III: Chapter 6 (Sec 6.1 - 6.5) **UNIT IV:** Chapter 8 (Sec 8.1 - 8.3)

UNIT V: Chapter 8 (Sec 8.4) & Chapter 10 (Sec 10.1 -10.2)

Reference

An Introduction to Measure and Integration, I. K. Rana, Narosa Publishing House, Delhi, 1997

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	RR3PMA10	Functional Analysis	6	5	English

UNIT I: Banach spaces: Definition and examples -continuous linear transformation – the Hahn – Banach theorem – natural imbedding of N in N** - open mapping theorem - the conjugate of an operator.

UNIT II: Hilbert spaces: Definition and some simple properties – orthogonal complements – orthonormal sets – conjugate space H* .

UNIT III: Conjugate of an operator – adjoint of an operator – self adjoint of an operator – normal and unitary operator, the structure of commutative banach algebras – gelfand mapping - applications of the formula $r(x) = lim\|x^n\|^{\frac{1}{n}}$ – involutions in banach algebras – gelfand – neumark theorem.

UNIT IV: Projections – finite dimensional spectral theory matrices- determinants and the spectrum of an operator – spectrum theorem.

UNIT V: General preliminaries on Banach algebras definition and some examples – regular and singular elements – topological divisors of zero – the spectrum – formula for spectral radius – radical and semi simplicity.

Text Book

Introduction to Topology and Modern Analysis, G. F. Simmons, McGraw Hill International Edition , New Delhi.

UNIT I: Chapter 9 (Sec 46 - 51) **UNIT II:** Chapter 10 (Sec 52 - 55)

UNIT III: Chapter 10 (Sec 56 - 58) & Chapter 13 (Sec 70 - 73)

UNIT IV: Chapter 11 (Sec 59 - 62) **UNIT V:** Chapter 12 (Sec 64 - 69)

Reference

Functional Analysis, B.V. Limaye, New Age International (p) Ltd, 2nd Edition.

Question Paper Pattern

Maximum Marks: 75 Examination Duration : 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	RR3PMA11	Stochastic Processes	6	5	English

UNIT I: Stochastic processes: Some notions - Introduction-Specification of stochastic processes – stationary processes – Mortingales – Difference equation: Differentiable-Difference equations. Markov chain -Definition and examples – High transition probabilities.

UNIT II: Generalization of independent Bernoulli trails: sequence of chain dependent trails – Classification of states and chain: Determination of higher transition probabilities – Stability of Markov system – Graph theoretic approach – Markov chain with denumerable number of states.

UNIT III: Markov processes with discrete state space: Poisson process and its extensions: Poisson process – Poisson process and related distributions – Generalizations of Poisson process – Birth death process.

UNIT IV: Markov processes with discrete state space (continuous time Markov chains)-Randomization Derived Markov chain – Erlang process. Markov process with continuous state space: Introduction: Brounian motion – Wiener process – Differential equations for a wiener process – Kolmogorov equation.

UNIT V: Stochastic Processes in Queueing system: General concepts – The queuing model M/M/1 : Steady state behavior. Transient behavior of M/M/1 model – Birth and death processes - The model M/M/S.

Text Book

Scope and Treatment as in Stochastic Processes, J.Medhi, Wiley Eastern Limited.

UNIT I: Chapter 2(Sec 2.1-2.4), Appendix A(A.2, A.2.1-A.2.4, A.3) & Chapte 3(Sec 3.1,3.2)
UNIT II: Chapter 3 (Sec 3.3 - 3.8) **UNIT III:** Chapter 4 (Sec 4.1 - 4.4)
UNIT IV: Chapter 4 (Sec 4.5 - 4.7) & Chapter 5 (Sec 5.1 - 5.4)
UNIT V: Chapter 10 (Sec 10.1 - 10.3, 10.4 (only 10.4.1, 10.4.2, 10.4.2.1))

Reference

1. A First course in Stochastic Process, S.Kqrlin and M.Taylor, Second Edition, Academic Press, Newyork (1975).
2. Elements of Applied Stochastic processes, U, N. Bhrt, 2nd edition, Wiley, New York (1968)

Question Paper Pattern

Maximum Marks: 75 Examination Duration : 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	RR3PMAEL3	Cryptography	6	4	English

UNIT I : Cryptography - Some Simple Cryptosystems – Enciphering Matrices.

UNIT II : Public Key - The Idea of Public Key Cryptography – RSA - Discrete Log.

UNIT III: Primality And Factoring - Pseudoprimes – The rho Method – Fermat factorization and factor bases.

UNIT IV: Primality And Factoring - The Continued Fraction Method – The Quadratic Sieve Method.

UNIT V: Elliptic Curves - Basic facts – Elliptic Curve Cryptosystems – Elliptic curve Primality Test.

Text Book

A Course in Number Theory and Cryptography, Neal Koblitz, Springer, Second Edition.

UNIT I: Chapter 3 (Sec 3.1, 3.2) **UNIT II:** Chapter 4 (Sec 4.1 – 4.3)

UNIT III: Chapter 5 (Sec 5.1 – 5.3) **UNIT IV:** Chapter 5 (Sec 5.4, 5.5)

UNIT V: Chapter 6 (Sec 6.1 - 6.3)

Reference

An Introduction to Cryptography, H.C.A. Van Tilborg, Kluwer Academic Publishers, Boston/ Dordrecht/Lancaster, 1988.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	RR4PMA12	Differential Geometry	6	5	English

UNIT I: Definitions of a Space Curves – Arc length – tangent normal and bi-normal - curvature and torsion – contact between Curves and surfaces.

UNIT II: Tangent surface, Involutes and Evolutes – Intrinsic equations – Fundamental existence theorem for Space Curves, Definition of surface - Curves on surface – Surfaces of Revolution.

UNIT III: Helicoids – Metric-Direction Coefficients – Families of Curves – Isometric Correspondences – Intrinsic Properties.

UNIT IV: Geodesic- Canonical Geodesic equations- Normal Properties of Geodesic – Existence Theorems – Geodesic parallels – Geodesic Curvature – Gauss – Bonnet Theorem – Gaussian Curvature – Surfaces of a constant curvature.

UNIT V: Second Fundamental Form – Principal Curvature – Developable- Developable associated with space curves- Developable associated with curves on surfaces- minimal surfaces – Ruled surfaces.

Text Book

Scope and treatment as in An Introduction to Differential Geometry, T.J Willmore, Oxford University Press, New Delhi.

UNIT I: Chapter 1 (sec 1 - 6) **UNIT II:** Chapter 1 (sec 7 - 9) & Chapter 2 (sec 1 - 3)

UNIT III: Chapter 2 (sec 4 - 9) **UNIT IV:** Chapter 2 (sec 10 - 18)

UNIT V: Chapter 3 (sec 1- 9)

Reference

Elementary Topics in Differential Geometry, J.A. Thorpe, Springer (India), 2004.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	RR4PMAEL4	Discrete Mathematics	6	4	English

UNIT I: Computability and Formal Languages - Introduction – Russell's paradox and Non-computability - Ordered Sets – Languages – Phrase Structure Grammars - Types of Grammars and Languages.

UNIT II: Finite State Machines - Introduction – Finite State Machines – Finite State Machine as Models of Physical Systems – Equivalent Machines – Finite State Machines as Languages Recognizers – Finite State Languages and Type-3 Languages.

UNIT III: Boolean Algebras - Lattices and Algebraic Systems – Principle of Duality – Basic Properties of Algebraic Systems Defined by Lattices – Distributive and Complemented Lattices – Boolean Lattices and Boolean Algebras – Uniqueness of Finite Boolean Algebras – Boolean Functions and Boolean Expressions.

UNIT IV: Discrete Numeric Functions and Generating Functions - Introduction – Manipulation of Numeric Functions – Asymptotic Behavior of Numeric Functions – Generating Functions – Combinatorial Problems

UNIT V: Recurrence Relations and Recursive Algorithms - Introduction - Recurrence Relations – Linear Recurrence relations with constant coefficients – Homogeneous Solutions – Particular Solutions – Total solutions – Solution by the Method of Generating Functions.

Text Book

Elements Of Discrete Mathematics, C. L. Liu, Tata McGraw Hill Publishing company Limited, New Delhi, Second Edition.

UNIT I: Chapter 2 (Sec 2.1 – 2.6) **UNIT II:** Chapter 7 (Sec 7.1 – 7.6)

UNIT III: Chapter 12 (Sec 12.1 – 12.7) **UNIT IV:** Chapter 9 (Sec 9.1 – 9.5)

UNIT V: Chapter 10 (Sec 10.1 – 10.7)

Reference

A course in discrete Mathematical structures, L.R. Vermani and Shalini, Imperial College Press London, 2011.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

Signature of the HOD

(For students admitted from 2015-2016 onwards)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	RR4PMAEL5	Applied Mathematics	6	4	English

UNIT I: FOURIER TRANSFORMS: Introduction – Fourier Integral Theorem – Fourier transform-Alternative Form of Fourier Complex Integral Formula- Relationship between Fourier Transform and Laplace transform-properties of Fourier Transform – Finite Fourier Transform.

UNIT II: Z- TRANSFORMS: Introduction – properties of Z-Transforms- Z-Transforms of some basic functions – Inverse Z-Transforms – Use of Z-Transforms to Solve Finite difference equations.

UNIT III: CALCULUS OF VARIATIONS AND APPLICATION: Introduction – Strong and Weak variations – The variational notation and the first variation – commutative character of the operators –The simplest variational problem - commutative character of the operators of variation and intergration – Eulers equation(only simple problems)-Brachistochrone problem -Sturm liouville problems.

UNIT IV: INTEGRAL EQUATIONS: Introduction – Relation between differential and integral equations- Relation between linear differential and Volterra integral equations-Volterra integral equation of the second kind- The Green's function.

UNIT V: Fredholm equation with separable kernels – Illustrative examples - Fredholm equations with symmetric kernels - Hilbert- Schmidt theory –Solution of non -homogeneous integral equation in terms of the characteristic solutions of the associated homogeneous equation -Hilbert- Schmidt method – Iterative method for solving equations of the second kind –Orthogonal kernals- The Neumann series.

Text Books

1. Engineering Mathematics-III, T.Veerarajan, Second Edition, Tata McGraw Hill Education, Private Ltd., New Delhi.

UNIT I: Chapter 2 (Sec 2.1 - 2.7) **UNIT II:** Chapter 5 (Sec 5.1 - 5.5)

2. Higher Mathematics for Engineering and Science, M K.Venkataraman, Fourth Edition, The National Publishing Company.

UNIT III: Chapter 9 (Sec 1 -7, 9) **UNIT IV :** Chapter 10 (Sec 1 - 5)

UNIT V : Chapter 10 (Sec 6 - 11)

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

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

Signature of the HOD