## DEPARTMENT OF MATHEMATICS
### M.Sc - Mathematics (Full Time)
#### Curriculum and Syllabus
##### 2017 Regulation

### I SEMESTER

<table>
<thead>
<tr>
<th>S.No</th>
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### II SEMESTER

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### IV SEMESTER

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**Credit Summary**
- 1st Semester - 16
- 2nd Semester - 16
- 3rd Semester - 16
- 4th Semester - 27
- **Total No. of Credits - 75**
## LIST OF ELECTIVES

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DEPARTMENT OF MATHEMATICS

HMMA17001 REAL ANALYSIS 4 0 0 4

OBJECTIVES:
❖ To give an in-depth knowledge of Real Analysis and their applications.
❖ To train the students in problem solving in Real Analysis.

UNIT I 12 Hours
(Chapters 2 and 3)

UNIT II 12 Hours
(Chapters 4 and 5)

UNIT III 12 Hours
Definition and Existence – Properties – Integration and Differentiation – Integration of vector valued functions.
(Chapter 6)

UNIT IV 12 Hours
Uniform Convergence and Continuity – Uniform Convergence and Differentiation – Equicontinuous families of functions – The Stone – Weierstrass Theorem. (Chapter 7)

UNIT V 12 Hours
Linear Transformations - Differentiation – The Contraction Principle – The Inverse Function Theorem - The Implicit Function Theorem. (Chapter 9, Sections 9.1 to 9.29)

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17002 LINEAR ALGEBRA 4 0 0 4

OBJECTIVES
❖ To give an in-depth knowledge of Algebra and their applications.
❖ To train the students to write definition and problem solving in Algebra.

UNIT I 12 Hours
Vector Spaces – Subspaces – Linear Independence and Dependence – Basis and Dimension – Sum of subspaces - Coordinates.

UNIT II 12 Hours

UNIT III 12 Hours

UNIT IV 12 Hours
Cyclic Subspaces and Annihilators – Cyclic Decomposition and the Rational Form – The Jordan Canonical form.

UNIT V 12 Hours
Inner product spaces – Orthogonal complement – Linear functionals and Adjoints – Unitary operators – Normal operators.

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17003 ADVANCED NUMERICAL ANALYSIS 4 0 0 4

Objectives
❖ To know the theory behind various numerical methods.
❖ To apply these methods to solve mathematical problems.

UNIT I 12 Hours

UNIT II 12 Hours
Error Analysis of Direct methods – Operational count of Gauss elimination, Vector norm, Matrix norm, Error Estimate. Iteration methods - Jacobi iteration method, Gauss Seidel Iteration method, Successive Over Relaxation method - Convergence analysis of iterative methods, Optimal Relaxation parameter for the SOR method. Finding eigen values and eigen vectors – Jacobi method for symmetric matrices and Power methods only. (Chapter 3 § 3.3[Pages 134-140], 3.4[Pages 146-164], 3.5[Pages 170-173], 3.7 [ Pages179-185] and 3.11 [Pages 196-198]).

UNIT III 12 Hours
Hermite Interpolations, Piecewise and Spline Interpolation: piecewise linear interpolation, piecewise quadratic interpolation, piecewise cubic interpolation, spline interpolation-cubic Spline interpolation. Bivariate Interpolation-Lagrange Bivariante interpolation. Least square approximation. (Chapter 4 § 4.5 - 4.7 & 4.9 [Pages 284-290])

UNIT IV 12 Hours
Numerical Differentiation – Optimum choice of Step length – Extrapolation methods – Partial Differentiation. Numerical Integration: Methods based on undetermined coefficients - Gauss Legendre Integration method and Lobatto Integration Methods only. (Chapter 5 § 5.2 - 5.5[Pages 320-345] and 5.8[pages 361 – 365 and 380-386])

UNIT V 12 Hours

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17004 ORDINARY DIFFERENTIAL EQUATIONS 4 0 0 4

Objectives:
❖ To give an in-depth knowledge of differential equations and their applications.
❖ To train the students to solve the problems in ODE.

UNIT I 12 Hours

UNIT II 12 Hours

UNIT III 12 Hours
Euler Equation – Second order equations with regular singular points – Convergence Proof – Bessel Equation – Regular singular points at infinity.

UNIT IV 12 Hours

UNIT V 12 Hours

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17005       COMPLEX ANALYSIS       4    0    0    4

Objectives:

❖ To give an in-depth knowledge of Complex Analysis and their applications.
❖ To train the students to solve the problems in Complex Analysis.

UNIT I          12 Hours

UNIT II         12 Hours
Complex Integration – Curves in the Complex Plane – Basic Properties of Complex Integrals – Winding Number of a Curve – Cauchy-Goursat Theorem – Homotopy Version – Morera’s Theorem-Cauchy Integral Formula. (pp.191 – 258 of the Text)

UNIT III        12 Hours
Laurent’s Series – The Maximum Modulus Principle – Schwarz Lemma – Application to Conformal Mapping - Liouville’s Theorem – Gauss Theorem – Lucas Theorem. (pp. 259 – 300 of the Text)

UNIT IV         12 Hours
Isolated and Non-isolated Singularities - Removable Singularity – Poles – Singularities at Infinity - Residue at a Finite Point – Residue at the Point at Infinity – Residue Theorem. (pp.313 – 335, pp.347 – 375 of the Text)

UNIT V          12 Hours

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:

M.Sc- Mathematics - 2017 Regulations
Objectives:

❖ To give an in-depth knowledge of Partial Differential equations and their applications.
❖ To apply them in scientific and engineering problems.

UNIT I 12 Hours

UNIT II 12 Hours

UNIT III 12 Hours

UNIT IV 12 Hours

UNIT V 12 Hours

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
DEPARTMENT OF MATHEMATICS

HMMA17007 MECHANICS 4 0 0 4

OBJECTIVES:
❖ To give an in-depth knowledge of Mechanics and their applications.
❖ To apply them in scientific and engineering problems.

UNIT I 12 Hours
The Mechanical system - Generalized coordinates - Constraints - Virtual work - Energy and Momentum
(Chapter 1: Sections 1.1 to 1.5)

UNIT II 12 Hours
Derivation of Lagrange's equations - Examples - Integrals of motion.
(Chapter 2: Sections 2.1 to 2.3 [Omit Section 2.4])

UNIT III 12 Hours
Hamilton's Principle - Hamilton's Equation - Other variational principle.
(Chapter 4: Sections 4.1 to 4.3 [Omit section 4.4])

UNIT IV 12 Hours
Hamilton Principle function - Hamilton-Jacobi Equation - Separability
(Chapter 5: Sections 5.1 to 5.3)

UNIT V 12 Hours
Differential forms and generating functions - Special Transformations - Lagrange and Poisson brackets.
(Chapter 6: Sections 6.1, 6.2 and 6.3 [omit sections 6.4, 6.5 and 6.6])

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
Objectives:
❖ To give an in-depth knowledge of Mathematical Statistics and their applications.
❖ To apply them in scientific and engineering problems.
❖ To train the students to solve the problems in Mathematical Statistics.

UNIT I
12 Hours
Notion of a sample and a statistic - Distribution functions of X, S^2 and (X , S^2) - \( \chi^2 \) distribution - Student t-distribution - Fisher’s Z - distribution - Snedecor’s F - distribution - Distribution of sample mean from non-normal populations. (Chapter 9: Sections 9.1 to 9.8)

UNIT II
12 Hours
Concept of a statistical test - Parametric tests for small samples and large samples -\( \chi^2 \) test - Kolmogorov Theorem 10.11.1 - Smirnov Theorem 10.11.2 - Tests of Kolmogorov and Smirnov type - The Wald-Wolfovitz and Wilcoxon - Mann-Whitney tests - Independence Tests by contingency tables. (Chapter 10: Sections 10.11; Chapter 11: 12.1 to 12.7)

UNIT III
12 Hours
Preliminary notion - Consistency estimation - Unbiased estimates - Sufficiency - Efficiency - Asymptotically most efficient estimates - methods of finding estimates - confidence Interval. (Chapter 13: Sections 13.1 to 13.8 [Omit Section 13.9]

UNIT IV
12 Hours
One way classification and twoway classification. Hypotheses Testing: Poser functions - OC function - Most Powerful test - Uniformly most powerful test - unbiased test. (Chapter 15: Sections 15.1 and 15.2 [Omit Section 15.3]; Chapter 16: Sections 16.1 to 16.5 [Omit Section 16.6 and 16.7])

UNIT V
12 Hours
SPRT - Auxiliary Theorem - Wald’s fundamental identity - OC function and SPRT - E(n) and Determination of A and B - Testing a hypothesis concerning p on 0-1 distribution and m in Normal distribution. (Chapter 17: Sections 17.1 to 17.9 [Omit Section 17.10])

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
DEPARTMENT OF MATHEMATICS

Objectives
To give an in-depth knowledge of Metric Space, Normed Space and Some Named theorem
To train the students to solve the problems in Functional Analysis

UNIT I
12 Hours
Metric Space – Examples – Open Set, Closed Set, Neighbourhood – Convergence, Cauchy Sequence, Completeness – Examples – Completeness Proofs – Completion of Metric Spaces. (pp. 1 – 45 of the Text)

UNIT II
12 Hours
Normed Space – Banach Space – Properties of Normed Spaces – Finite dimensional Normed Spaces and Subspaces – Compactness and Finite Dimension – Linear Operators – Bounded and Continuous Linear Operators – Linear Functionals – Linear Operators and Functionals on Finite Dimensional Spaces – Normed Spaces of Operators – Dual Space. (pp. 58 – 125 of the Text)

UNIT III
12 Hours

UNIT IV
12 Hours

UNIT V
12 Hours

TEXT BOOKS:

REFERENCES:
4. Thamban Nair (2002), Functional Analysis –A First Course, PHI.

Total No. of hours: 60
Objectives
To give an basic knowledge of Definitions, theorems and their applications.
To apply them in scientific and engineering problems.
To train the students to solve the problems in Calculus of Variations and integral equations.

UNIT I
12 Hours
The concept of Variation and its properties – Euler’s equation – Variational problems for functional – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of mechanics. (Chapter 1: 1.1 to 1.7)

UNIT II
12 Hours
Movable boundary for a functional dependent on two functions – One sided variations – Reflection and Refraction of extremals – Diffraction of light rays. (Chapter 2: 2.1 to 2.5)

UNIT III
12 Hours
Integral equations: Introduction – Definition – Regularity conditions – Special kinds of Kernels – Eigen values and eigen functions – Convolution integral – Reduction to a system of algebraic equations – Examples – Fredholm alternative – Examples – An approximation method. (Chapter 1: 1.1 to 1.5 Chapter 2 : 2.1 to 2.5)

UNIT IV
12 Hours
Method of successive approximations – Iterative scheme – Examples – Volterra integral equations – Examples – Some results about the resolvent kernel – The method of solution of Fredholm equation – Fredholm first theorem – Examples. (Chapter 3: 3.1 to 3.5 Chapter 4: 4.1 to 4.3)

UNIT V
12 Hours
Initial value problems – Boundary value problems – Examples – Singular integral equations – The Abel integral equations - Examples. (Chapter 5: 5.1 to 5.3 Chapter 8: 8.1 to 8.2)

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17011  TOPOLOGY  4 0 0 4

Objectives
To give an in-depth knowledge of Topological spaces and their applications.
To train the students to develop analytical thinking and the study of continuity and connectivity.

UNIT I  12 Hours
Topological spaces - Basis for a topology - The order topology - The product topology on X x Y - The subspace topology - Closed sets and limit points. (Chapter 2: Sections 12 to 17)

UNIT II  12 Hours
Continuous functions - the product topology - The metric topology. (Chapter 2: Sections 18 to 21 [Omit Section 22])

UNIT III  12 Hours
Connected spaces - connected subspaces of the Real line - Components and local connectedness. (Chapter 3: Sections 23 to 25)

UNIT IV  12 Hours
Compact spaces - compact subspaces of the Real line - Limit Point Compactness - Local Compactness. (Chapter 3: Sections 26 to 29)

UNIT V  12 Hours
The Countability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The Urysohnmetrization theorem - The Tietz extension theorem. (Chapter 4: Sections 30 to 35)

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
Objectives
To give an in-depth knowledge of Optimization Techniques and their applications.
To train the students to Solve the problems in Optimization Techniques.

UNIT I
12 Hours

UNIT II
12 Hours
Introduction to Linear Programming – Two-Variable LP Model – Graphical Solution – Solutions of Maximization and Minimization Models – Simplex Method – Computational Details of the Simplex Algorithm - M-Method –Two-phase Method-Degeneracy. (Ch.2 pp. 11-20, Ch.3 pp. 80-83, 94-105)

UNIT III
12 Hours

UNIT IV
12 Hours
Integer Linear Programming – Illustrative Applications – Branch-and-Bound Algorithm – Cutting Plane Algorithm – Traveling Salesperson Problem – B&B Solution Algorithm,(Ch.9 pp.361-378, 384-397)

UNIT V
12 Hours

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17E01 MATHEMATICAL MODELING AND APPLICATIONS 4 0 0 4

Objectives
To give an in-depth knowledge of Mathematical Modeling and their applications.
To train the students to solve the problems in Mathematical Modeling.

UNIT I 12 Hours

UNIT II 12 Hours

UNIT III 12 Hours

UNIT IV 12 Hours
Review of Basic Graph Theory - Modeling through Graphs , Directed Graphs , Signed Graphs and Weighted Digraphs and Unoriented Graphs – Modeling through Functional Equations .(Ch.7 pp.151-176, Ch.8 pp.177-183 of Book 1)

UNIT V 12 Hours

Total No. of hours: 60.

TEXT BOOKS:

REFERENCES:
1. Thomas, Saaty, Joyce, M.A, Thinking With Models, Pergamon Press.
Objectives
To give an in-depth knowledge of Fluid Dynamics and their applications.
To train the students to solve the problems in Fluid Dynamics.

UNIT I

UNIT II
Real Fluids and Ideal Fluids – Velocity of a Fluid at a Point – Streamlines and pathlines – Velocity Potential – Vorticity Vector – Local and Particle Rates of Change – The Equation of Continuity – Acceleration – Conditions at a Rigid Boundary – General Analysis of Fluid Motion – Pressure at a Point in a Fluid at Rest and in a Moving Fluid – Euler’s Equations of Motion – Bernoulli’s Equation – The Case of Steady Motion Under Conservative Body Forces. (pp.70 – 110 of the Text)

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCES:

Total No. of hours: 60
Objectives
To give an in-depth knowledge of Probability theory and Stochastic process and their applications.
To train the students to solve the problems in Probability Theory.

UNIT I
12 Hours
Probability Theory-Introduction- Sample space and events – Conditional probabilities – Independent Events – Baye’s formula – simple problems.(Sections 1.1- 1.6 of the Text)

UNIT II
12 Hours
Random variables- Discrete Random variables- Continuous random variables – Expectation of a random variable- Joint distributed random variables – Moments and Moment generating functions-Limit theorems –Conditional expectations - simple problems. (Sections 2.1 - 2.7., 3.4., 3.5 of the Text)

UNIT III
12 Hours

UNIT IV
12 Hours

UNIT V
12 Hours
Introduction to Brownian motion- Gambler’s ruin problem –Variations on Brownian motion - Pricing stock options- White Noise-Gaussian processes – Simple Applications (Sections 10.1., 10.3- 10.6 of the Text )

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
Objectives
To give an in-depth knowledge of Applied Algebra and their applications.
To train the students to solve the problems in Rings, Fields and Coding theory.

UNIT I
12 Hours

UNIT II
12 Hours
Polynomial Rings and Polynomial Codes: The Ring R[x] - Polynomial Rings over Fields – Polynomial Codes – Advantageous Properties - Shift Registers – Unique Factorization Theorem for Polynomials – Polynomial Functions and Formal Derivatives. (pp.315 – 339 of Book 1)

UNIT III
12 Hours
Fields –Quotient Field – Prime Field – Examples and Definitions – Simple Extensions – Finite Extensions - Finite Fields – Cyclotomic Polynomials – Factorization of Polynomials over finite fields- Berlekamp’s Algorithm. (pp.124 – 175 of Book 2)

UNIT IV
12 Hours
Coding Theory: Introduction to Coding – Hamming distance –Hamming Bounds – Linear Codes – Generator Matrix – Decoding Algorithm – Hamming Code – Cyclic Codes – Special Cyclic Codes – BCH Code – Decoding BCH Codes. (pp.183 – 236 of Book 2)

UNIT V
12 Hours
Cryptology: Classical Cryptosystems – Modular Enciphering – Caesar Cipher, Affine Cipher, Periodic Substitution Cipher – Hill Cipher – Examples – Public Key Cryptosystems - RSA Cryptosystem – Discrete Logarithms and Other Ciphers. (pp.239 – 279 of Book 2)

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
DEPARTMENT OF MATHEMATICS

HMMA17E05  Fuzzy Sets and Fuzzy Logic  4 0 0 4

Objectives
To give an in-depth knowledge of Fuzzy sets and Fuzzy Logic and their applications.
To train the students to solve the problems in Fuzzy Sets.

UNIT I

UNIT II
Operations on Fuzzy Sets: Types – Fuzzy Complements – Fuzzy Intersections –Fuzzy Unions – Combinations of Operations – Aggregation Operations. (pp.50 – 94 of the Text)

UNIT III

UNIT IV

UNIT V

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
HMMA17E06 Statistical Quality Control 4 0 0 4

Objectives
To give an in-depth knowledge of Statistical Quality Control and their applications.
To train the students to solve the problems in Statistical Quality Control.

UNIT I 12 Hours

UNIT II 12 Hours
Control Charts for Attributes: Control Chart for Fraction Non-conforming – p, np Charts - Variable Sample Size – O.C.Functions – Control Charts for Non-conformities (Defects) – C Chart – Procedures with Constant Sample Size – O.C.Functions. (Ch.5.1 – 5.3.1 & 5.3.4 of the Text)

UNIT III 12 Hours
Control Charts for Variables: Introduction – Control Charts for X and R – Development and Use of X and R Charts – Control Limits – Specification limits and Natural Tolerance Limits – Probability Limits on the X and R Charts – Interpretation O.C.Functions. (Ch.6.1 – 6.2.2 upto pp.183, pp.187-192 & Ch.6.2.6 of the Text)

UNIT IV 12 Hours
Acceptance Sampling : Lot-by Lot Acceptance Sampling for Attributes – Acceptance Sampling Problem – Advantages and Disadvantages – Single Sampling Plan for Attributes – OC Curve – Effects of n and c on OC Curve – Type A and Type B – OC Curves – Designing SSP with a specified OC Curve - AOQ & ATI. (Ch.10.1 – 10.1.1, Ch.10.2 of the Text)

UNIT V 12 Hours
Acceptance Sampling by Variables: Types of Sampling Plans Available – Caution and use of Variables Sampling – Designing a Variables Sampling Plan with a Specified OC Curve – MIL-STD-105D and MIL-STD –414 - Dodge-Romig Sampling Plans & Uses.(Ch. 11.1 – 11.2, 10.5.1-10.5.2, 10.6, 11.3.1-11.3.2 of the Text)

Total No. of hours: 60

TEXT BOOKS:
Objectives
To study the applications of Graph Theory in other disciplines.

UNIT I
12 Hours
Graphs - Graph Isomorphism - The Incidence and Adjacency Matrices – Subgraphs - Vertex Degrees - Paths and Connection - Cycles - Trees - Cut Edges and Bonds - Cut Vertices.
(Chapter 1 Section 1.1 - 1.7; Chapter 2 Section 2.1 - 2.3)

UNIT II
12 Hours
Connectivity - Blocks - Euler tours - Hamilton Cycles. (Chapter 3 Section 3.1 - 3.2; Chapter 4 Section 4.1 - 4.2)

UNIT III
12 Hours
Matchings - Matchings and Coverings in Bipartite Graphs - Edge Chromatic Number - Vizing’s Theorem.
(Chapter 5 Section 5.1 - 5.2; Chapter 6 Section 6.1 - 6.2)

UNIT IV
12 Hours
Independent sets - Ramsey’s Theorem - Chromatic Number - Brooks’ Theorem - Chromatic Polynomials.
(Chapter 7 Section 7.1 – 7.2; Chapter 8 Section 8.1 – 8.2, 8.4)

UNIT V
12 Hours
Plane and planar Graphs - Dual graphs - Euler’s Formula - The Five-Colour Theorem and the Four-Colour Conjecture.
(Chapter 9 Section 9.1 - 9.3, 9.6)

Total No. of hours: 60

TEXT BOOKS:

REFERENCES:
Objectives
To give an in-depth knowledge of Discrete Mathematics and their applications.
To train the students to solve the problems in Discrete Mathematics.
To introduce the different notions grammar.

UNIT I
12 Hours


UNIT II
12 Hours


UNIT III
12 Hours


UNIT IV
12 Hours


UNIT V
12 Hours


Total No. of hours: 60

TEXT BOOKS:

REFERENCES: