### PG SYLLABUS

Effective from the Academic Year 2006-07

<table>
<thead>
<tr>
<th>Sem</th>
<th>SUB Code</th>
<th>Title</th>
<th>Cre</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>MC MT 1804</td>
<td>LINEAR ALGEBRA</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>MC MT 1805</td>
<td>REAL ANALYSIS</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>MC MT 1806</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>I</td>
<td>MC MT 1807</td>
<td>DIFFERENTIAL GEOMETRY</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>MC MT 1808</td>
<td>COMPUTER ALGORITHMS</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>MC MT 2804</td>
<td>ALGEBRA</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>MC MT 2805</td>
<td>MEASURE THEORY AND INTEGRATION</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>MC MT 2806</td>
<td>PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>MC MT 2807</td>
<td>COMPLEX ANALYSIS</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>SE MT 2951</td>
<td>FORMAL LANGUAGES AND AUTOMATA</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>SE MT 2952</td>
<td>NUMERICAL METHODS USING C++</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>SU MT 2901</td>
<td>MATHEMATICAL METHODS</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>SU MT 2902</td>
<td>LINEAR ALGEBRA AND MATRIX THEORY</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>SU MT 2903</td>
<td>MATHEMATICAL PHYSICS</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>SU MT 2904</td>
<td>MATHEMATICAL FOUNDATION FOR</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>MC MT 3803</td>
<td>TOPOLOGY</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>MC MT 3804</td>
<td>CLASSICAL MECHANICS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>MC MT 3805</td>
<td>ANALYTIC NUMBER THEORY</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>MC MT 3806</td>
<td>ALGORITHMIC GRAPH THEORY</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>ID MT 3875</td>
<td>MATHEMATICAL METHODS IN BIOLOGY</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>ID ZO 3875</td>
<td>BIO-MATHMATICS</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>CP MT 3925</td>
<td>MATHEMATICAL SOCIAL SCIENCES</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>MC MT 4804</td>
<td>FUNCTIONAL ANALYSIS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>MC MT 4805</td>
<td>RELATIVISTIC MECHANICS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>MC MT 4806</td>
<td>FLUID DYNAMICS</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>MC MT 4807</td>
<td>OPERATIONS RESEARCH</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>SE MT 4954</td>
<td>THEORY OF FUZZY SUBSETS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>SE MT 4955</td>
<td>PARALLEL INTERCONNECTION NETWORKS</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>SE MT MT</td>
<td>FINANCIAL MATHEMATICS</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>
MT 1804 - LINEAR ALGEBRA

Objectives: To introduce the basic concepts and methods in the study of Linear Transformation on finite dimensional Vector spaces and their Matrix Forms.

Unit 1: Characteristic values – Annihilating Polynomials – Invariant Subspaces – Simultaneous Triangulation; Simultaneous Diagonalization.

Unit 2: Direct sum decompositions – Invariant Direct sums – The Primary Decomposition theorem – Cyclic subspaces and Annihilators.


Unit 4: Forms on Inner Product Spaces – Positive Forms – More on Forms – Spectral theory.

Unit 5: Bilinear forms – Symmetric bilinear forms – Skew-symmetric bilinear forms – Group preserving bilinear forms.

TEXT BOOKS:
[Chapter 6 : sections 6.2 to 6.8, Chapter 7 : sections 7.1 to 7.4, Chapter 9 : sections 9.2 to 9.5, Chapter 10 : sections 10.1 to 10.4]

REFERENCES:

MT 1805 - REAL ANALYSIS

Objectives: To give a systematic study of Riemann Stieltjes Integral and the calculus on R^n and a brief study of convergence of sequences and series, Power series, Fourier series and polynomials.

Unit 1: Riemann-Stieltjes Integral: Definition and Properties of the Integral-Integration and Differentiation-Integration of vector valued functions

Unit 2: Functions of Several Variables: Differentiation-Chain Rule-Partial Derivatives -The Contraction Principle.


Unit 5: Polynomials: Approximation – Motivation -Taylor Polynomial - Interpolating Polynomial - Tchebyshev Polynomial

TEXT BOOKS:
[Pages 120 - 136, 211 - 221, 143 - 159, 184 - 196]
2. Dr. Rangan, “Real Analysis (Part II), New Century Book House (P) Ltd.
[Chapter 12 – Pages 282 - 298]

REFERENCES:
MT 1806 - ORDINARY DIFFERENTIAL EQUATIONS

SEMESTER : I  CREDIT : 3
CATEGORY : MC  NO. OF HOURS / WEEK : 5

Objectives: To learn mathematical methods to solve Higher Order Differential Equations and apply to dynamical problems of practical interest.

Unit 1: Linear Differential Equations of Higher Order – Linear dependence and Wronskian – Basic theory of linear equations – Method of variation of parameters – Two useful formula – Homogeneous Linear equations with Constant Coefficients.

Unit 2: Method of Frobenius – Bessel’s functions – Legendre’s equation – Legendre polynomials – Successive Approximations.

Unit 3: Rodrigue’s formula – Gauss equation – Hypergeometric function.


Unit 5: Stability of Quasi linear systems – autonomous systems – non-autonomous systems – a special Lyapunav function.

TEXT BOOKS:

REFERENCES:

MT 1807 - DIFFERENTIAL GEOMETRY

SEMESTER : I  CREDIT : 4
CATEGORY : MC  NO. OF HOURS / WEEK : 6

Objectives: To teach some applications of abstract algebra and analysis to geometrical problems and facts.

Unit 1: Curves – Analytical representation – Arc length, tangent – Osculating plane – Curvature – Formula of Frenet.

Unit 2: Contact – Natural equations – General solution of the natural equations – Helics – Evolutes and Involutes.


TEXT BOOKS:
MT 1808 - COMPUTER ALGORITHMS

Objectives: To motivate the students to Computational Mathematics, a recent trend in both educational and industrial fields.


Unit 2: Divide and Conquer – General method, Binary search, Mergesort, Quick sort

Unit 3: The Greedy Method – Knapsack problem, Job sequencing with dead lines, Optimal storage on tapes, Optimal merge patterns.

Unit 4: Basic traversal – Inorder, preorder, postorder traversals, Breadth first search and traversal, Depth first search and traversal

   Backtracking – Sum of subsets, n-Queens problem (n = 4, 8).

Unit 5: NP – Hard and NP – complete problems – Basic Concepts, Cook’s Theorem (Statement only), Conjunctive Normal Form (CNF) – satisfiability reduces to Clique Decision Problem (CDP). The Clique Decision Problem (CDP) reduces to The Node Cover Decision Problem

TEXT BOOKS:

MT 2804 - ALGEBRA

Objectives:
1. To introduce to the students the general concepts in Abstract Algebra.
2. To give a foundation in various algebraic structures.

Unit 1: (Groups – Symmetry)

Unit 2: (More about Groups)
   The operation of a group on itself – The class equation of the Icosahedral group - Operations on subsets – The Sylow theorems – The group of order 12 - Computation in the symmetric group – The Free groups.

Unit 3: (Modules)
   The definition of a Module – Matrices, Free modules and Bases – The principle of permanence of identities – Generators and Relations for modules – The structure theorem for Abelian groups.
Unit 4: (Field Extensions)


Unit 5: (Galois Theory)

Elements of Galois theory – Solvability by radicals – Galois Group over the rationals.

TEXT BOOKS:
   [Chapter 5 – Sections 1 – 9, Chapter 6 – Sections 1 – 7, Chapter 12 – Sections 1, 2, 3, 5, 6]
   [Chapter 5 – Sections 5.1, 5.3, 5.5, 5.6, 5.7, 5.8, Chapter 7 – Section 7.1]

REFERENCES:

MT 2805 - MEASURE THEORY AND INTEGRATION

SEMESTER : II CREDIT : 3 CATEGORY : MC NO. OF HOURS / WEEK : 5

Objectives:
1. To provide a basic course in Lebesgue Measure and Integration and a study of inequalities and the L^pspaces.
2. To study signed measures and decomposition theorems.

Unit 1: Measure on the Real Line

Introduction - Lebesgue outer measure-measurable sets-Borel sets-Regular measure - Lebesgue measurable function-Borel measurable function..
MT 2806 - PARTIAL DIFFERENTIAL EQUATIONS

SEMESTER : II  CREDIT : 2
CATEGORY : MC  NO. OF HOURS / WEEK : 4

Objective: To give an introduction to Mathematical techniques in analysis of P.D.E.

Unit 1: First Order P.D.E.

Formulation of P.D.E - Compatibility - Classification of Integrals - Charpit’s Method- Jacobi Method - Special Types of First Order Equations - Cauchy’s Method.

Unit 2: Second Order P.D.E.


Unit 3: Elliptic Differential Equations

Laplace and Poisson Equation- Boundary Value Problems-Dirichlet Problem for a circle - Neumann Problem for a circle.

Unit 4: Parabolic and Hyperbolic Differential Equations


Unit 5: Integral Transforms and Green Function Method

Laplace Transforms- Fourier Transforms and Their Applications-Green Function Method and its Applications.

TEXT BOOK:

REFERENCES:

MT 2807 - COMPLEX ANALYSIS

SEMESTER : II  CREDIT : 4
CATEGORY : MC  NO. OF HOURS / WEEK : 7

Objectives:
1. To lay the foundation for topics in Advanced Complex Analysis.
2. To develop clear thinking and analyzing capacity for research.

Unit 1: Power series representation of analytic functions – zeros of an analytic function – the index of a closed curve – Cauchy’s theorem and integral calculus – the homotopic version of Cauchy’s theorem – Goursat’s theorem.


Unit 4: Runge’s theorem – Mittag-Leffler’s theorem – Jensen’s formula – Hadamard’s factorization theorem.

Unit 5: Simply periodic functions – Doubly periodic functions – Elliptic functions – the Weierstrass theory.
MT 2951 - FORMAL LANGUAGES AND AUTOMATA

SEMESTER : II  CREDIT : 3
CATEGORY : SE  NO. OF HOURS / WEEK : 5

Objectives:
1. To provide an insight to theoretical computer science.
2. To get across to the students the notion of effective computability, using mathematical models

Unit 1: Finite Automata and Regular Expressions

Finite state systems – Basic definitions – Non-deterministic finite automata – Finite automata with ε-moves – Regular expressions.

Unit 2: Properties of Regular Sets


Unit 3: Context-Free Grammars


MT 2952 - NUMERICAL METHODS USING C++

SEMESTER : II  CREDIT : 3
CATEGORY : SE  NO. OF HOURS / WEEK : 5

Objectives:
1. To expose the students to various tools in solving numerical problems.
2. To enable the students to apply these methods in a computer environment.

Unit 1: Introduction to C++


Unit 2: System of Linear Equations


TEXT BOOK:

REFERENCES:

TEXT BOOK:
[Chapter: 2.1 – 2.5, 3.1 – 3.4, 4.1 – 4.5, 5.1 – 5.3, 7.1 – 7.4.]

TEXT BOOK:
[Chapter: 2.1 – 2.5, 3.1 – 3.4, 4.1 – 4.5, 5.1 – 5.3, 7.1 – 7.4.]
Unit 3: Non-linear Equations and Interpolation

Bisection method – Newton’s method – Interpolation - Newton’s divided difference formula – Lagrange’s interpolation – Newton’s forward and backward difference formula.

Unit 4: Differentiation and Integration


Unit 5: Ordinary Differential Equations


TEXT BOOK:

REFERENCES:

MT 2901 - MATHEMATICAL METHODS

SEMESTER : II CREDIT : 3
CATEGORY : SU NO. OF HOURS / WEEK : 4

Objectives:
1. To provide a mathematical background to the principles of Economics.
2. To help analyze and solve problems in Economics.

Unit 1: Analytical Geometry

Straight lines – Two point form – Intercept form – Point-slope form – Slope-intercept form – Parallel, perpendicular and intersecting lines – Applications of straight lines in Business and Economics – Linear demand and supply curves – Market equilibrium – Break even analysis.

Unit 2: Integration


Unit 3: Differential Equations


Unit 4: Difference Equations

Definition and classification of Difference equation – solutions of difference equations – linear first order difference equation with constant coefficients – The Harrod model.

Unit 5: Vector Differentiation

Definition of a vector – Vector differentiation of linear function - vector function – quadratic forms and bilinear forms – application of vector differentiation in maximization and minimization.

TEXT BOOK:
REFERENCES:
1. Allan, R G D., Mathematical Analysis for Economists, Macmillan
2. Archibald, G C and Richard G Lipsey., An Introduction to a Mathematical Treatment of Economics, All India Traveller Book Seller, New Delhi, 1990

MT 2902 - LINEAR ALGEBRA AND MATRIX THEORY

SEMESTER : II CREDIT : 3
CATEGORY : SU NO. OF HOURS / WEEK : 4

Objective: To provide a foundation in Linear Algebra concepts, approaches and methods for the Post-Graduate Statistics students

Unit 1: Algebra of Matrices
Linear transformations and matrices-Operations on matrices-Properties of matrix operation – Matrices with special structures
Rank and Inverse
Row space and column space- Inverse of a matrix- Properties of inverse-Rank of real and complex matrices-Change of basis

Unit 2: Linear Equations
Homogenous systems-General linear system-Generalised inverse of a matrix –Sweep out method for solving Ax = b

Unit 3: Inner product space
Inner product-Norm-Orthogonality and orthogonal basis-Orhtogonal complement

Unit 4: Eigen values
Characteristic roots – Eigen vectors and eigen spaces- Cayley-Hamilton theorem and minimum polynomial – Spectral representation of a semi simple matrix – Spectral theorems

Unit 5: Quadratic Forms
Definition of a quadratic form – Classification of quadratic forms – Rank and signature – p.d and n.n.d matrices – Hermitian forms

TEXT BOOK:
Chapt 2: 2.2 to 2.4, Chapt 3:3.2 to 3.4, 3.9 and 3.10, Chapt 5: 5.1 to 5.5, Chapt 7: 7.2 to 7.5, Chapt8: 8.2 to 8.5 and 8.7, Chapt9: 9.1 to 9.4 and 9.8

REFERENCES:

MT 2903 - MATHEMATICAL PHYSICS

SEMESTER : II CREDIT : 3
CATEGORY : SU NO. OF HOURS / WEEK : 4

Objective: To expose the students to areas of mathematics having applications in physics.

Unit 1: Complex Analysis I
Functions of a complex variable- The derivative-Cauchy Riemann differential equations- Analytic functions and singularities- Line integrals-Cauchy’s integral theorem-Cauchy’s integral formula for derivatives.

Unit 2: Complex Analysis II
Unit 3: Integral Transforms

Laplace transforms and applications-Fourier series for periodic functions- Dirichlet conditions- Half range series- Complex form of Fourier series-Fourier transforms.

Unit 4: Differential Equations


Unit 5: Special Functions

Bessel, Legendre, Hermite and Laguerre equations - Properties of their solutions-Recurrence relations-Orthogonal properties.

TEXT BOOK:

4. Bell, Special Functions for Scientists and Engineers-Van Nostrand Company. London

REFERENCES:

1. Butkov, Mathematical Physics.

MT 2904 - MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

SEMESTER: II CREDIT: 3 CATEGORY: SU NO. OF HOURS / WEEK: 4

Objectives: To provide the mathematical concepts and methods as a foundation to learn theoretical computer science.

MT 3803 : TOPOLOGY

SEMESTER: III CREDIT: 3 CATEGORY: MC NO. OF HOURS / WEEK: 5

Objectives: To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.
Unit 1: Metric Spaces

Partially ordered sets, lattices, metric spaces, definitions and examples, open sets and closed sets, convergence, completeness and Baires theorem, continuous mappings, spaces of continuous functions, Euclidean and Unitary spaces.

Unit 2: Topological Spaces

Definitions and examples, elementary concepts, open base and open subbase, weak topologies and the function algebras.

Compactness

Compact spaces, product of spaces, Tychonoff’s theorem and locally compact spaces and compactness for metric spaces, Ascoli's theorem.

Unit 3: Separation Axioms

$T_1$ spaces, Hausdorff’s spaces, completely regular spaces and normal spaces, Urysohn’s lemma, the Tietze extension theorem, the Urysohn’s imbedding theorem, the Stone-Čech compactification.

Unit 4: Connectedness

Connected spaces, the components of a space totally disconnected spaces and locally connected spaces.

Unit 5: Approximation

The Weierstrass approximation theorem, the Stone-Weierstrass theorem, locally compact Hausdorff spaces, the extended Stone-Weierstrass theorem.

TEXT BOOK:

1. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Company. [Part One Chapters 1 to 7]

REFERENCES:


MT 3804 CLASSICAL MECHANICS

SEMESTER: III CREDIT: 3
CATEGORY: MC NO. OF HOURS / WEEK: 5

Objectives: To provide the student with a thorough mastery both of the fundamentals and of significant contemporary research developments.


Unit 2: Hamilton’s principle -Derivation of Lagrange’s equation from Hamilton’s principle.-Legendre transformation and the Hamilton Canonical equation of motion.-Cyclic coordinates and Routh’s procedure -Conservation theorems -Derivation from variational principle

Unit 3: The principle of least action-The types of periodicity -The discussion of the motion of the Top by Lagrange’s method and by Hamilton’s method.-The equations of Canonical transformation - Examples – the integral invariants of Poincare’-Lagrange and Poisson brackets and Canonical invariants

Unit 4: Equation of motion in Poisson bracket -Infinitesimal contact transformation - the angular momentum Poisson brackets relations - Lioville’s theorem - The Hamilton - Jacobi equation for Hamilton’s principle function.

Unit 5: The Harmonic Oscillator problem as example of Hamilton – Jacobi method Hamilton’s-characteristic function – Separation
of variables in Hamilton-Jacobi equation - Action angle variables – The Kepler Problems in Action-angle variables.

**TEXT BOOK:**
1. Classical Mechanics - H.Goldstein-Addison Wesley. Chapters 1, 2, 3, 7, 8 & 9

**REFERENCES:**

---

**MT 3805 ANALYTIC NUMBER THEORY**

**SEMMESTER** : III  **CREDIT** : 2  
**CATEGORY** : MC **NO. OF HOURS / WEEK** : 4

**Objectives:**
1. To introduce the concepts of arithmetic function, Dirichlet multiplication, averages of arithmetic functions, congruences and quadratic residues and teach some techniques of solving problems. 
2. To introduce the analytical methods used in Number Theory.

**Unit 1: Arithmetical Functions and Dirichlet Multiplication**

The Mobius function \( \mu(n) \) – The Euler totient function \( \varphi(n) \) – A relation connecting \( \mu \) and \( \varphi \) - A product formula for \( \varphi(n) \) – The Dirichlet product of arithmetical functions – Dirichlet inverses and the Mobius inversion formula – The Mangoldt function \( \Lambda(n) \) – Multiplicative functions – Inverse of a completely multiplicative function.

**Unit 2: Averages of Arithmetical Function**

The big oh notation – asymptotic equality of functions – Euler’s summation formula – elementary asymptotic formulas – Average order of \( d(n) \), of divisor function \( \sigma_a(n) \), \( \varphi(n) \), \( \mu(n) \) and \( \Lambda(n) \).

**Unit 3: Congruences**


**Unit 4: Quadratic Residues & the Quadratic Reciprocity Law**


**Unit 5: Partitions**

Geometric representation of partitions – Generating functions for partitions – Euler’s pentagonal-number theorem – Euler’s recursion formula for \( p(n) \).

**TEXT BOOK:**
2. W.J.Leveque, Topics in Number Theory, Addison Wesley.

References:
2. W.J.Leveque, Topics in Number Theory, Addison Wesley.
MT 3806 ALGORITHMIC GRAPH THEORY

Objectives:
1. To provide the foundation of the graph theoretic notions.
2. To learn the algorithmic design and analysis techniques

Unit 1: Basic definitions and notations – Intersection graphs – The complexity of Computer Algorithms – How to explore a graph.


Unit 4: Characterizing Permutation Graphs – Permutation Labelings – Sorting a permutation using queues in parallel.


TEXT BOOK:

REFERENCES:

MT 3875 MATHEMATICAL METHODS IN BIOLOGY

Objectives: To introduce Mathematics as a tool in the study of Biology.

Unit 1: Sequence alignments, Basic string definitions, The importance of sequence comparison in Molecular Biology, The edit distance between two strings, String alignment, Edit graphs, String similarity, Alignment graphs, Local alignment, Introduction to Gaps, CDNA matching, A concrete illustration, Choices for gap weights, Time analysis.

Unit 2: Overview of RDBMS, Advantages of DBNS, Normalization, Oracle data types, Introduction to SQL, DDL, DML, & TLC commands. Data definition Language, Data Manipulation Language, Transaction Control & data, Control language Grant & Revoke Privilege Command.

Unit 3: Multiple sequence alignments, the morphological to the molecular, Common multiple alignment methods, multiple sequence alignments, Local alignment gaps, parametric sequence alignments, suboptimal alignments, Multifunction tools for sequence analysis.

Unit 4: Phylogenetic analysis, Evolutionary Trees and Phylogeny, Ultrasonic trees, Parsimony, Ultrametric problem, Perfect phylogeny, Phylogenetic alignment, Connection between multiple alignment and tree construction, Methods in Phylogeneic Analysis, Profiles and Motifs

REFERENCES:
7. Dan Gusfield, Algorithms on Strings, trees and sequences, Cambridge University Press, USA.

ZO 3875 BIO-MATHEMATICS
(For II M.Sc. Zoology Students)

SEMESTER : III  CREDIT : 3
CATEGORY : ID  NO. OF HOURS / WEEK : 4

Objectives: To introduce Mathematics as a tool in the study of Biology.

Unit 1: Determinants
Properties of determinants, Minors, Cofactors, Multiplications of determinants.

Matrices
Operations on matrices, Inverse of matrices, Solution of simultaneous equations.

Unit 2: Permutation and Combination
Identities and simple problems, Binomial theorem, Exponential and Logarithmic series (statement only), Simple problems.

Basic ideas of Graph Theory
Connectivity, Trees, Various matrices connected with graphs, Construction of evolutionary trees, Phylogeny Construction.

Unit 3: Limits, Differentiation, Successive differentiation, Maxima and Minima, Simple problems.
Integration of $f(x) = x^n, e^x, \log x$, Definite integrals, Simple problems.

Unit 4: Fundamentals of computers, algorithms, flowcharts. Introduction to systems and Application programs. Concept of data processing and handling of file for large volume of data. Elements of Database management in connection with Biological data bases.

Unit 5: C – programming and internet programming fundamentals. Specific features of Image Analysis in Java. Software characteristics and applications – Clustal W VI.7, Rasmol, Oligo, Molscript, Tree view, ALSCRIPT, Genetic analysis software, Phylip.

REFERENCES:

MT 3925 MATHEMATICAL SOCIAL SCIENCES

SEMESTER : III  CREDIT : 3
CATEGORY : CP  NO. OF HOURS / WEEK : 4

Objectives: To equip the students with a sample of available tools/techniques in Mathematics to study and analyze the social issues and to give a first hand experience in using / experimenting with the techniques.
Unit 1: Introduction to social sciences

Some fundamental concepts in social sciences – Research, survey, investigation and experiment. Hypothesis in social research. Questionnaire, Experimental design in social research. Examples from case studies.

Unit 2: Graph theoretic tools / techniques

Conversion of issues to graphs, weighted graphs, popular models, Examples from case studies. Techniques used in Numerical Methods, Examples from case studies.

Unit 3: Statistical tools / techniques


Unit 4: OR tools / techniques


Unit 5: Fuzzy tools / Techniques

Fuzzy - Neural network models, Examples from case studies.

REFERENCES:

3. Research methodology - CR Kothari
5. Statistical methods - J.N.Kapoor
6. Fuzzy sets and Fuzzy Logic- George J. Klife and Bo Yuan.

TEXT BOOK:

1. Mojumdar, P.K., Research Methods in Social Sciences, Viva Books Pvt Ltd., (2005) chapters: 2.1 - 2.3 and 3 (full), 4.5 and 8.1, 8.2, 8.8, 17.4-17.7 and 8.11
2. Bart Kosko, Neural Networks and Fuzzy systems, Prentice Hall of India, New Delhi (2003). Chapters: 3, 4 and 8

MT 4804 FUNCTIONAL ANALYSIS

SEMESTER : IV CREDIT : 3
CATEGORY : MC NO. OF HOURS / WEEK : 5

Objectives: To study the details of Banach and Hilbert Spaces and to introduce Banach algebras.


Unit 3: The Natural Embedding of a Normal Space in its second dual – Reflexivity – Open Mapping and Closed Graph Theorems – Projections.

Unit 5: Finite Dimensional Spectral Theory and Banach Algebra –
Finite Dimensional Spectral Theory – Regular and Singular Elements –
Topological Divisor of Zero – The Spectrum – Formula for the Spectral Radius –
Topological Vector Spaces – Normal Spaces – Locally Convex Spaces.

TEXT BOOK:
1. Goffman, H.C., Fredrick, G., First course in Functional Analysis, Prentice Hall of
India, New Delhi, 1987.

REFERENCES:
1. Limaye, B.V., Functional analysis,
2. G.F.Simmons , Introduction to topology and Modern Analysis, McGraw Hill
5. E. Kreyszig Introductory Functional Analysis with Applications, John wiley & Sons,

MT 4805 RELATIVISTIC MECHANICS

SEMESTER : IV  CREDIT : 3
CATEGORY : MC  NO. OF HOURS / WEEK : 5

Objectives: To provide the student to study the subject from a
Mathematician’s point of view. Tensor Calculus gives all that
is needed on the subject to understand the theory of
relativity.

Unit 1: The Galilean transformation-Michelson – Morely experiment-
postulates of special theory – Lorentz transformations –
consequences of Lorentz transformations – Formula for composition
of velocities – phenomenon of aberration – Doppler effect.

Unit 2: Relativistic Mechanics – mass and momentum – Equivlaence
of mass and energy – Relativistic transformation for mass –
density – force – Minkowski’s world – space loke and time –
time intervals.

Unit 3: Coordinate transformation – Summation convention -
contravariant and Covariant vectors – contravariant, covariant
and mixed tensors - Algebra of Tensors – Quotient law –
Fundamental tensors – Christoffel symbols – covariant
differentiation of vectors and tensors.

Unit 4: Geodesic – Uniform vector field – Condition for flat space -
Principle of covariance and principle of equivalence- effect of
gravity on a light ray – Riemann Christoffel tensor – Necessary
and sufficient condition for the space – time – Einstein law of
gravitation for empty space.

Unit 5: Schwarzchild’s solution – planetary orbits – Advance of
perihelion – The deflection of light – isotropic coordinates –
material energy tensor.

TEXT BOOK:
1. Special theory of Relativity - Resnik, Wiesley Eastern
3. Riemanian geometry & tensor calculus - Weatherburn - Cambridge University
Press.

MT 4806 FLUID DYNAMICS

SEMESTER : IV  CREDIT : 2
CATEGORY : MC  NO. OF HOURS / WEEK : 4

Objectives: To introduce the students to fluids in motion,
Equations of motion of a fluid, two-dimensional flows, three-
dimensional flows and viscous flows.

Unit 1: Euler’s and Lagrange’s descriptions of flow – material
derivative continuity equation – irrotational and solenoidal
velocity fields – boundary conditions for a material surface –
circulation – Kelvin’s theorem on circulation.

Unit 2: Euler’s equation of motion – Bernoulli’s theorems – Vorticity
– Helmholtz vorticity theorem – two dimensional motion – stream
function – complex potentials.


TEXT BOOK:

REFERENCES:
1. Fluid Dynamics, Schaum’s series.

MT 4807 OPERATIONS RESEARCH

Objectives: To provide the students mathematical techniques to model and analyse decision problems, with effective application to real life in optimization of objectives.

Unit 1: Integer Programming

Pure and mixed integer programming problems and applications – Cutting plane algorithm – The branch and bound algorithm – Gomory’s cutting plane algorithm – Zero one implicit enumeration.

Dynamic Programming


Unit 2: Inventory Models

The ABC inventory systems and JIT inventory systems – Deterministic models – single item static model with and without pricebreaks – multiple item static models with storage limitations – probabilistic models – A continuous review single period models – multiple period models.

Unit 3: Queuing Models

Poisson process – pure birth death process – M/M/1, M/M/C, M/Ek/1 queuing models – steady state probabilities – waiting time distribution.

Network Models

Cost considerations in network models.

Unit 4: Advanced topics in Linear Programming

Goal programming – Stochastic programming – Sensitivity analysis.

Unit 5: Non Linear Programming

Lagrangian multiplier method – Necessary and Sufficient conditions due to Kuhn Tucker – Quadratic Programming by Wolfe’s Method.

TEXT BOOK:

REFERENCES:

MT 4954  THEORY OF FUZZY SUBSETS

SEMESTER : IV  CREDIT : 3
CATEGORY : SE  NO. OF HOURS / WEEK : 5

Objectives: The theory of fuzzy subsets is a step forward a rapprochement between the precision of classical mathematics and the pervasive imprecision of the real world-a rapprochement born of the incessant human quest for a better understanding of mental processes and cognition.

Unit 1: Introduction- Review of the notion of membership-The concept of a fuzzy subset-Dominance relations-Simple operations on fuzzy subsets-Set of fuzzy subsets for E and M finite-Properties of the set of the fuzzy subsets-Product and algebraic sum of two fuzzy subsets

Unit 2: Fuzzy graphs-Fuzzy relations-Composition of fuzzy relations -Fuzzy subsets induced by a mapping -Conditioned fuzzy subsets -Properties of fuzzy binary relation -Transitive closure of a fuzzy binary relation-Paths in a finite fuzzy graph

Unit 3: Fuzzy preorder relations -Similitude sub relations in a fuzzy preorder- Antisymmetry - Fuzzy order relations-Ant symmetric relations without loops - Ordinal relations- Ordinal functions in a fuzzy order relation-Dissimilitude relations -Resemblance relations -Various properties of similitude and resemblance- Various properties of fuzzy perfect order relations-Ordinary membership functions


Unit 5: Review of the notion of a law of composition-Laws of fuzzy internal composition. - Fuzzy groupoids-Principal properties of fuzzy groupoids -Fuzzy monoids -Fuzzy external composition -Operations on fuzzy numbers

TEXT BOOK:

MT 4954  COMMUTATIVE ALGEBRA

SEMESTER : IV  CREDIT : 3
CATEGORY : SE  NO. OF HOURS / WEEK : 5

Objectives: To do an advanced course in Algebra also to high light the applications of Algebra in Theoritical computer Science.

Unit 1: Rings and ideals - Rings and ring homomorphisms.- Operations on ideals – extensions and contractions.

Unit 2: Modules – modules and module homomorphisms – Sub modules and quotient modules – Operations on sub modules – Direct sum and product. Finitely generated modules – Exact sequences.

Unit 3: Rings and modules of fractions – Properties - extended and contracted ideals in rings and fractions.
Unit 4: Primary Decomposition.

Unit 5: Integral dependence and Variations – Integral dependence –
   The going up theorem – The going down theorem.

TEXT BOOK:

REFERENCES:
1. O. Zariski and P. Samuel, Commutative Algebra, Volume I and II.

MT 4955 PARALLEL INTERCONNECTION NETWORKS

Objectives:
1. To give an insight into Theoretical Computer Science.
2. To understand the structures of various interconnection networks.

Unit 1: Interconnection Networks, Trees and k-ary trees, Embedding
   of graphs, Planar Graphs and Layout of VLSI Circuits, Diameter
   of Graphs.

Unit 2: Vertex transitive graphs, Edge Transitive graphs, Cayley
   graphs, Properties of Cayley graphs, Vertex transitive Cayley
   graph.

Unit 3: Hypercube networks, de Bruijn networks.

Unit 4: Circulant networks, Mesh networks, Cube connected cycles,
   Butterfly networks, Benes networks.

Unit 5: Fault tolerance of networks, Basic Principles of network
   design, Routing in networks, Forwarding index of routing, Edge-
   Forwarding index of routing, Delay of Fault-tolerant routing.

TEXT BOOK:

MT FINANCIAL MATHEMATICS

Objectives:
1. To lay theoretical foundation with potential applications to financial problems
2. To provide efficient introduction to theoretical skills that are genuinely used in financial institutions

Unit 1: Probability and Events - Conditional Probability - Random
   Variables and Expected Values - Covariance and Correlation - Continuous Random Variables - Normal Random Variables - Properties of Normal Random Variables - Central Limit Theorem - Geometric Brownian Motion as a limit of Simpler Models - Brownian Motion.

Unit 2: Interest Rates - Present Value Analysis - Rate of Return - Continuously Varying Interest Rates - Options pricing - pricing Via Arbitrage.


Unit 4: Call Options on Dividend Paying Securities - Pricing American Put Options - Estimating the Volatility Parameter - Limitations of Arbitrage Pricing - Valuing Investments by
Expected utility - The Portfolio Selection Problem - Value at Risk and Conditional value at Risk - The Capital Assets Pricing Model - Mean variance Analysis of Risk, Neutral and Priced Call Options - Rates of Return.


TEXT BOOK:

REFERENCES: