

SCHOOL OF MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Mathematics, Statistics and Computer Science together constitute a school with wide scope for interaction aiming at excellence in fundamental research and applications.

The University of Madras is known for its nurturing the genius in Srinivasa Ramanujan, the great mathematical luminary whose mathematics is engaging the attention of leading mathematicians even today for its profundness and applications. The University department of Mathematics was created in 1927. The Ramanujan Institute of Mathematics, founded by Dr.Rm.Alagappa Chettiar came into existence in 1957. In 1967, with the assistance from UGC it become a Centre of Advanced Study in Mathematics merging the two units. This centre is now known as the Ramanujan Institute for Advanced Study in Mathematics (RIASM). The RIASM offers Masters, M.Phil. and . programmes.

An independent Department of Statistics started functioning in 1941 and became a full fledged Department of study and research from 1975 under the leadership of Prof K.N.Venkataraman. The Department offers Masters M.Phil. and Ph.D. programmes. The Department also offers Master's Programme in Actuarial Science, UGC's innovative programme

Study of Computer Science in the University began in 1984. An independent department was instituted in 1995. The Department of Computer Science concentrates research in the areas of Parallel Algorithms, Architectures and Applications, Parallel Computing, Computational Geometry and it too has a well equipped Computer Laboratory. The department currently offers Master of Computer Applications and programmes.

Faculty

Dr.S. Parvathi - Chairperson

RIAS in Mathematics

S. Parvathi, . - Professor and Director
R. Parvatham, . - Professor
N. Sthanumoorthy, . - Professor
K. Parthasarathy, . - Professor
Premalatha Kumaresan, . - Professor
M. Loganathan, . - Professor
V. Thangaraj, . - Professor
R. Sahadevan, . - Professor
V.Balasubramanian, . - Professor
V.R. Chandran, . - Reader
Agarwal Sushma, . - Lecturer

Statistics

G.Gopal, . - Professor and Head
P.Dhanavanthan, . - Professor
M.R.Srinivasan, . - Reader
T. Anbupalam, . - Lecturer (on study leave)
M.R. Sindhumol - Lecturer
K.M.Sakthivel - Lecturer (on contract)

Computer Science

P.Thangavel, . - Reader and Head in-charge.
S.Gopinathan - Lecturer
P.L. Chitra - Lecturer
Sornam, - Lecturer
B.Lavanya - Lecturer

M.Sc. MATHEMATICS

Course Code	Title of the Course	C/E SS	Credits				Faculty
			L	T	P	C	
I SEMESTER							
MSI C001	Linear Algebra	C	3	1	0	4	M.Loganathan
MSI C002	Real Analysis	C	3	1	0	4	G.Balasubramanian
MSI C003	Ordinary Differential Equations	C	3	1	0	4	R.Sahadevan
	Elective – I	E	2	1	0	3	Faculty Concerned
II SEMESTER							
MSI C004	Algebra	C	3	1	0	4	S.Parvathi
MSI C005	Topology	C	3	1	0	4	M.Loganathan
MSI C006	Partial Differential Equations	C	3	1	0	4	R.Sahadevan
MSI C007	Computational Mathematical Laboratory – I	C	0	0	2	2	Guest Faculty
	Elective – II	E	2	1	0	3	Faculty Concerned
III SEMESTER							
MSI C008	Complex Analysis – I	C	3	1	0	4	G.Balasubramanian
MSI C009	Measure and Integration Theory	C	3	1	0	4	Premalatha Kumaresan
MSI C010	Probability Theory	C	3	1	0	4	V.Thangaraj
MSI C011	Seminar	C	2	0	0	2	All Faculty Members
	Elective –III	E	2	1	0	3	Faculty Concerned
	Elective – IV	E	2	1	0	3	Faculty Concerned
IV SEMESTER							
MSI C012	Complex Analysis – II	C	3	1	0	4	Premalatha kumaresan
MSI C013	Differential Geometry	C	3	1	0	4	K.Parthasarathy
MSI C014	Functional Analysis	C	3	1	0	4	Agrawal Sushama N.
MSI C015	Computational Mathematical Laboratory – II	C	0	0	2	2	R.Sahadevan
	Elective – V	E	2	1	0	3	Faculty Concerned
	Elective – VI	E	2	1	0	3	Faculty Concerned

A - Elective Courses Offered by the RIASM

Course Code	Title of the Course	C/E/S /	Credits				Faculty
			L	T	P	C	
MSI E001	Discrete Mathematics	E	2	1	0	3	Guest Faculty
MSI E002	Number Theory and Cryptography	E	2	1	0	3	Guest Faculty
MSI E003	Programming and Soft Computations	E	1	1	1	3	Guest Faculty
MSI E004	Computer Based Numerical Methods	E	1	1	1	3	Guest Faculty
MSI E005	Lie Algebras	E	2	1	0	3	N.Sthanumoorthy
MSI E006	Stochastic Processes	E	2	1	0	3	V.Thangaraj
MSI E007	Representation Theory of Finite Groups	E	2	1	0	3	S.Parvathi
MSI E008	Graph Theory	E	2	1	0	3	M.Loganathan
MSI E009	Lie Groups of Transformations & Ordinary Differential Equations	E	2	1	0	3	R.Sahadevan
MSI E010	Lie Groups of Transformations and Partial Differential Equations	E	2	1	0	3	R.Sahadevan
MSI E011	Fourier Analysis	E	2	1	0	3	K.Parthasarathy
MSI E012	Potential Theory in R^n	E	2	1	0	3	Premalatha Kumaresan
MSI E013	Linear Lie groups	E	3	0	0	3	K.Parthasarathy
MSI E014	Banach Algebras and Operator theory	E	3	0	0	3	Agrawal Sushama N.
MSI E015	Commutative Algebra	E	2	1	0	3	S.Parvathi
Self-Study Courses							
MSI S001	Algebraic Theory of Numbers	SS	0	4	0	4	S.Parvathi

MSI S002	Algebraic Topology	SS	0	4	0	4	M.Loganathan
MSI S003	Financial Calculus	SS	0	4	0	4	V.Thangaraj
MSI S004	Fuzzy Analysis	SS	0	4	0	4	N.Agrawal Sushama
MSI S005	Harmonic Function Theory	SS	0	4	0	4	Premalatha Kumaresan
MSI S006	Infinite dimensional Lie algebras	SS	0	4	0	4	N.Sthanumoorthy
MSI S007	Introduction to Fractals	SS	0	4	0	4	K.Parthasarathy
MSI S008	Lie Groups and Lie Algebras	SS	0	4	0	4	K.Parthasarathy
MSI S009	Probability on Abstract Spaces	SS	0	4	0	4	V.Thangaraj
MSI S010	Quantum Computations	SS	0	4	0	4	V.Thangaraj
MSI S011	Quantum Groups	SS	0	4	0	4	S.Parvathi
MSI S012	Soliton equations and Hirota derivatives	SS	0	4	0	4	N.Sthanumoorthy

The detailed syllabi for Self-study courses will be provided at the time of Registration by the faculty concerned

Masters Courses - Abstract

MSI C001	Linear Algebra	3	1	0	4	M.Loganathan
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Pre-requisite: Undergraduate Level Mathematics.

Course Objective:

To lay the foundation for a variety of courses.

Unit I : Linear transformations – The Algebra of Linear Transformations – Representation of Transformations by Matrices - Linear Functionals.

Unit II : The Algebra of Polynomials – Determinants – Properties of Determinants – Characteristic Polynomials – Eigen values – Eigen vectors – Invariant subspaces - Direct sum Decompositions - Diagonalization.

Unit III : The Primary Decomposition Theorem - Rational form - Jordan canonical form .

Unit IV : Bilinear forms - positive - definite, symmetric and Hermitian forms – Sylvester’s theorem.

Unit V : Spectral representation of real symmetric, Hermitian and normal operators - Applications.

MSI C004	Algebra	3	1	0	4	S.Parvathi
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Pre-requisite: Undergraduate Level Mathematics.

Course Objective:

To lead the aspirant to modern aspects of Algebra.

Unit I : Groups - homomorphisms, isomorphisms, - cosets, quotient groups - group of motions of the plane - finite groups - solvable groups.

Unit II : Classical Groups – group actions – extension of fields, finite fields.

Unit III: Counting formula - symmetric groups - Sylow theorems.

Unit IV: Fields – Algebraic and transcendental elements – degree extension – adjunction of roots – algebraically closed fields - splitting fields.

Unit V : Galois theory : Galois extension, Galois Fields, - Applications of Galois theory.

MSI C002	Real Analysis	3	1	0	4	G.Balasubramanian
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Pre-requisite: Undergraduate Level Mathematics.

Course Objective:

To provide a systematic development of Riemann – Stieltjes integral and the calculus on \mathbb{R}^n

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

Unit II : Sequences and Series of functions : Pointwise Convergence – Uniform Convergence – Weierstrass Approximation Theorem.

Unit III : Special Functions: Power Series – Exponential and Logarithmic Functions – Trigonometric Functions – Fourier series – Gamma function.

Unit IV : Functions of Several Variables: Derivatives of a function from \mathbb{R}^n to \mathbb{R}^m – Chain Rule – Partial Derivatives – Derivatives of Higher order.

Unit V : Basic Theorems of Differential Calculus: Inverse function Theorem – Implicit function Theorem – Rank Theorem.

MSI C005	Topology	3	1	0	4	M.Loganathan
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Pre-requisite: Undergraduate Level Mathematics and MSI 1003.

Course objective:

Topology is a basic discipline of pure Mathematics. Its ideas and methods have transformed large parts of geometry and analysis. It has also greatly stimulated the growth of abstract algebra. Much of modern pure mathematics must remain a closed book to person who does not acquire a working knowledge of at least the elements of Topology.

Unit I : Topological spaces - subspaces – product spaces – continuous functions - homeomorphisms .

Unit II : Connectedness - compactness

Unit III: Separation properties - Urysohn's lemma - Tietze's extension theorem .

Unit IV: Separable and second countable spaces – metrization theorems.

Unit V : Homotopy - fundamental group – induced homomorphisms - covering spaces - fundamental group of the circle.

MSI C003	Ordinary Differential Equations	3	1	0	4	R.Sahadevan
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Pre-requisite: Undergraduate Level Mathematics.

Course objective:

To learn mathematical methods to solve higher ordinary and partial differential equations and apply to dynamical problems of practical interest.

Unit I: HIGHER ORDER LINEAR EQUATIONS General Theory of nth order Linear Equations - Homogeneous equations with Constant Coefficients - The Method of Undetermined Coefficients - The Method of Variation of Parameters

Unit II : POWER SERIES SOLUTIONS AND SPECIAL FUNCTIONS Series Solutions of First Order Equations - Second Order Linear Equations – Ordinary Points - Regular singular Points - Gauss's Hypergeometric Equation

Unit III : SOME SPECIAL FUNCTIONS OF MATHEMATICAL PHYSICS AND EXISTENCE AND UNIQUENESS THEOREM Legendre Differential Equation: Solutions and its Properties - Bessel's Differential equations: Solutions and its Properties - The Method of Successive approximations - Existence Uniqueness Theorem.

Unit IV : NONLINEAR DIFFERENTIAL EQUATIONS AND STABILITY The Phase plane- Linear systems – Autonomous systems and stability – Almost Linear systems- Competing species – Predator Prey equations – Liapunov method

MSI C006	Partial Differential Equations	3	1	0	4	R.Sahadevan
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Course objective:

To give an introduction to mathematical techniques in and analysis of partial differential equation

FIRST ORDER EQUATIONS : Cauchy problem – Linear equations - Integral surfaces-Surfaces orthogonal to a given system – Compatible system – Charpits method – Special types of first order equations – Solutions satisfying given conditions – Jacobi's method. SECOND ORDER EQUATIONS – Linear equations with constant and variable coefficients – characteristic curves – The solution of hyperbolic equations – Separation of variables – The method of integral transforms. The Laplace equation – Elementary solutions – Families of equipotential surfaces-Boundary value problems- Separation of Variables- wave equation – elementary solutions-Riemann,Volteera solution – Diffusion equation and its Solutions. NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS: Introduction- One dimensional nonlinear wave equation- Method of Characteristics-Linear and nonlinear dispersive wave- The Korteweg de Vries equation and solitons.

MSI C007	Computational Mathematical Laboratory – I	0	0	2	2	Guest Faculty
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Pre – requisite:

Calculus, Linear Algebra, basic knowledge of Differential Equations and some knowledge of Programming Language.

Course Objective:

This is the first of two-semester Computational Mathematical Laboratory sequence (MSI 1008 to MSI 2008). In this sequence, we will emphasize the fundamentals of numerical computation and analysis: to explain how, why, and when numerical methods can be expected to work along with soft computational techniques using MAPLE/MATHEMATICA.

Section I : Mathematical Software : MAPLE/MATHEMATICA

Plotting Curves-Composition of functions, inverses-Sequences and series (finite and infinite sum)-Slope of a line, a secant, a tangent-Equations of tangents-Limit and continuity-2-D and 3-D graphs-Symbolic - Differentiation and Symbolic Integration- Conversion of coordinates, Areas in Polar coordinates- Symbolic manipulation on matrices - Solution to equations - Solution to Differential equations.

Section II : Programming Exercises using C+

1. Non-Linear Equations Bisection Method
 - 1.1 Regula-falsi Method
 - 1.2 Newton-Raphson Method
 - 1.3 Secant Method
 - 1.4 Fixed Point Iteration
2. System of linear Equations
 - 1.5 Gauss Elimination
 - 1.6 Gauss-Seidel Method
3. Interpolation
 - 1.7 Lagrange's Interpolation Formula
 - 1.8 Newton Interpolation Formula
3. Numerical Differentiation
 - 1.9 Differentiation using limits
 - 1.10 Differentiation using Extrapolation
4. Numerical Integration
 - 1.11 Composite Trapezoidal Rule
 - 1.12 Composite Simpson's 1/3 Rule
5. Numerical Solution to Differential Equations
 - 1.13 Euler's Method
 - 1.14 Taylor's Method of order 4
 - 1.15 Runge-Kutta Method of order 4
 - 1.16 Milne-Simpson Method

MSI C008	Complex Analysis – I	3	1	0	4	G.Balasubramanian
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Pre-requisite: Undergraduate Level Complex Analysis .

Course Objective:

This course provides (i) A modern treatment of classical Complex Analysis (ii) Methods to solve problems (iii) Means to apply Complex Analysis to various other branches of Mathematics

Unit I : Linear Transformations – Line integrals – Cauchy's theorem for a rectangle– Cauchy's theorem in a disc.

Unit II : Cauchy's integral formula – Higher derivatives – Zeros and poles – Maximum Principle.

Unit III: Homology – General form of Cauchy's theorem – locally exact differentials

Unit IV: The residue theorem – the argument principle – evaluation of definite integrals

Unit V : Harmonic Functions – The Mean value property- Poisson's formula – Schwarz's theorem – The reflection principle.

MSI C012	Complex Analysis-II	3	1	0	4	Premalatha Kumaresan
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Pre-requisite: Undergraduate level Mathematics, MSI 1004 and MSI 2001

Course objective:

(i)A modern treatment of advanced topics (ii) The application of Complex Analysis to Number theory.

Unit I : Power Series Expansion – Taylor Series – Laurent series – Canonical products – The Gamma Function

Unit II : The Riemann Zeta Function – The product Development- Extension of $\zeta(z)$ to the whole plane- The Functional equation – the Zero of the Zeta function.

Unit III : Jensen's formula – Hadamard's theorem – Normal families - Equicontinuity – Normality and compactness – Arzela's theorem – Families of Analytic functions.

Unit IV : Riemann Mapping theorem, Functions with mean value property, Harnacks principle, Dirichlet Problem

Unit V : Simply Periodic functions, Doubly periodic functions Weierstrass \wp -function, The functions $\zeta(z)$ and $\sigma(z)$.

MSI C009	Measure and Integration Theory	3	1	0	4	Premalatha Kumaresan
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Pre-requisite: Undergraduate level Mathematics

Course Objective:

To develop the theory of integration via: measure, the knowledge of which is essential for working in most branches of modern Analysis.

Unit I : Lebesgue outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue Measurability.

Unit II : Integration of non- negative functions, the general integral. Integration of series, Riemann and Lebesgue integrals.

Unit III : Functions of bounded variation, Differentiation and Integration, Abstract measure spaces, Completion of a measure

Unit IV : Signed measures, Hahn, Jordan Decompositions, Radon Nikodym derivatives, Lebesgue Decomposition.

Unit V : Measurability in a product space, the product measure and Fubini's theorem, Lebesgue measure in Euclidean space.

MSI C013	Differential Geometry	3	1	0	4	K.Parthasarathy
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Pre-requisite: MSI 1001 and MSI 1004

Course Objective:

To give a modern introduction to differential geometry of curves and surfaces.

Unit I : Plane curves, space curves, arc length, curvature, Frenet Serret Formula.

Unit II : Smooth surfaces: Examples of Smooth surfaces tangent, normal and orientability, first fundamental form, curves and surfaces, isometries.

Unit III : Curvature of smooth surfaces : Weingarten map and the second fundamental form, normal, principal, Gaussian and mean curvatures.

Unit IV : Surfaces of constant mean curvature, Gauss map, Geodesics.

Unit V : Gauss's theorem of Egregium, Gauss equation – Codazzi-Mainardi Equations, isometries of surfaces,

MSI C010	Probability Theory	3	1	0	4	V.Thangaraj
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Pre-requisite: Under Graduate level Calculus

Course objective:

This course provides- An axiomatic treatment of probability theory and an interplay between measure and probability- Different tools to solve mathematical problems.

Unit I : Probability space Axiomatic definitions for probability space(finite, countably infinite and uncountably infinite outcome spaces)- Events – Fields of events- σ - fields of events – conditional probability and Bayes' theorem

Unit II : Random Variables and their distributions Random Variables – distributions function – decomposition of distribution function – probability mass function and Probability density function – Classification of Random Variables – Moments and inequalities – Functions of Random Variables – Discrete and continuous distributions

Unit III : Independence, conditioning and Convergence Independence of events – of σ - fields –of Random Variables- conditional expectation – Radon – Nikodym derivatives – convergence of Random Variables(in Prob., a.s., in dist., r-th mean)

Unit IV : Characteristic functions Definitions and Simple properties – Inversion theorem – Moments and Characteristic functions – Weak convergence

Unit V : Limit Theorems Zero –one Laws – WLLN and SLLN for iid and id random variables. CLT for iid and id random variables

MSI C014	Functional Analysis	3	1	0	4	Agrawal Sushama N.
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Pre-requisite: Knowledge of MSI 1003 and 1004

Course objective:

Functional Analysis embodies the abstract approach to analysis. It highlights the interplay between algebraic structure and distance structures. It also provides a major link between Mathematics and its applications. Fundamentals of normed spaces, Completeness, continuity of linear maps, Hahn Banach theorems and their applications.

Unit I : Dual spaces, dual of l^p , L^p , Uniform boundedness principle, closed graph and open mapping theorems

Unit II : Inner product spaces, orthonormal sets - ,Riesz - Fischer theorems, Riesz Representation theorem.

Unit III : Bounded operators and adjoints, Projections, Projection theorem , Normal, Unitary and self-adjoint operators, spectrum of a bounded operator

Unit IV : Compact Operators, Spectral Theorem for Compact Selfadjoint Operators.

MSI C011	Seminar	2	0	0	2	All Faculty Members
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MSI C015	Computational Mathematical Laboratory - II	0	0	2	2	R.Sahadevan
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Description :

Introduction to computer graphics and mathematical computer programming in MAPLE, as tools for the solution of mathematical problems and for mathematical experimentation. Programming topics will include data types, expressions, statements, control structures, procedures and recursion. Examples and practical work will include computing with integers, polynomials, matrices, data files and numerical approximations. Practical work will form an integral part of the course and assessment.

Course Objective:

Students will learn to apply Maple to more advanced computation than that introduced in Computational Mathematics I. The main themes of the course are these: Mathematical problem solving. Visualising mathematical objectives via computer graphics and animation. Approximate numerical solution. Computer programming. Data structures: numbers; sequences, sets and lists; tables and arrays; algebraic structures. Program structures: conditional execution, loops and iteration; operators, procedures and functions; mapping over a structure; recursion. Date types: type testing; implementing polymorphism. Mathematics-> Algorithms-> Programs. Selected applications, such as implementing vector and matrix algebra; elementary data processing. Topics to be covered from following the Course: Linear Algebra, Real and Complex Analysis, Differential Geometry and Differential Equations

MSI E001	Discrete Mathematics	2	1	0	3	Guest faculty
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Pre-requisite: High school Level Mathematics:

Course Objective:

To introduce some basic mathematical concepts that are used in many computer science courses. To develop skills to use these concepts in certain practical applications.

Unit I : Mathematical Logic: Connection – Normal Forms – Theory of Inferences – Predicate Calculus.

Unit II : Set Theory: Operations on Sets – Basic Set Identities – Relations and Orderings.

Unit III : Recursion: Functions – Recursive Functions – Partial Recursive Functions.

Unit IV : Graph Theory: Basic Concepts of Graph Theory- Paths – Connectedness – Matrix Representation of Graphs – Trees – List structures and Graphs

Unit V : Grammers and Languages: Free Semigroups – Grammers and Languages.

MSI E002	Number Theory & Cryptography	2	1	0	3	Guest Faculty
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Pre-requisite: Undergraduate Level Mathematics:

Course Objective:

To provide an introductory course in Number theory. To introduce the fast growing and relevant topic of cryptography as an application of Number theory

Unit I : Elementary Number theory Divisibility and the Euclidean Algorithm, Congruences, Finite fields and Quadratic residues, Cryposystems, Enciphering matrices, Public key Cryptography, RSA, Discrete Log, Knapsack, Primality and Factoring.

Unit II : Introduction to classical cryptosystems-Some simple crypto systems , en ciphering matrices, DES

Unit III : Finate fields and quadratic residues-Finate fields, quadratic residues and reciprocity.

Unit IV : Public Key Cryptography-The idea of a public key Cryptography, RSA, Discrete Log, Algorithms to find discrete logs in finite Fields: Shank's giant – step - baby -step algorithm, Silver-Pohlig – Hellman's algorithm, Diffie – Hellman key - exchange system, ElGamal, zero – knowledge protocols

Unit V : Primality-Factoring and Elliptic curves.Pseudoprimes and strong Pseudoprimes, some methods to factor a composite integer:Pollard's rho method, fermat factorization and factor bases, the quadratic Sieve method, elliptic curves-basic facts, elliptic curve cryptosystems

MSI E003	Programming and Soft Computations	2	1	0	3	Guest Faculty
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Unit I : Tokens, Expressions and Control Structures – Functions in C++

Unit II : Classes and Objects – Constructors and Destructors

Unit III : Operator Overloading and Type conversions - Inheritance
 Unit I : Pointers – Virtual Functions and Polymorphism – Templates and Exception handling
 Unit V : Maple / Mathematica Commands (without programming)

MSI E004	Computer Based Numerical Methods	2	1	0	3	Guest Faculty
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Unit I : The solution of Nonlinear Equations $f(x)=0$ -Iteration for solving $x=g(x)$ – Bracketing methods for locating a root – Initial approximations and convergence criteria – Newton-Raphson and secant methods- Aitken’s and Steffensen’s and Muller’s methods
 Unit II : The solution of Linear systems $AX= B$ Upper triangular linear systems-Gaussian elimination and pivoting-Matrix inversion- Triangular factorization- Interpolation-Lagrange approximation – Newton polynomials
 Unit III : Numerical Differentiation, Integration and optimization Approximating a derivative – Numerical differentiation formulae – quadrature – Composite trapezoidal and Simpson’s rule – recursive rules – Romberg Integration – Minimisation of a function.
 Unit IV : Solution of Differential Equations Differential Equations – Euler’s method – Heun method- Taylor series method – Runge-Kutta methods – Predictor-Corrector methods
 Unit V : Solution to Partial differential methods
 Hyperbolic equations – Parabolic equations – Elliptic equations.

MSI E005	Lie Algebras	2	1	0	3	N.Sthanumoorthy
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Course objective:
 To initiate the study of Lie Algebras To motivate the student for research in Kac – Moody Lie Algebras and applications

Unit I : Basic Concepts of Lie Algebras
 Unit II : Ideals and homomorphisms
 Unit III : Solvable and nilpotent Lie algebras
 Unit IV : Semisimple Lie algebras : Theorems of Lie and Cartan, Killing form
 Unit V : Complete reducibility of representations and representation of $sl(2,F)$.

MSI E006	Stochastic Processes	2	1	0	3	V.Thangaraj
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Pre-requisite: MSI 2005

Course objective:
 This course aims

- To introduce standard concepts and methods of stochastic modeling
- To analyze the variability that are inherent in natural, engineering and medical sciences
- To provide new perspective, methodology, models and intuition and aid in other mathematical and statistical studies

Unit I : Markov chains, an introduction- Definitions, Transition probability matrix of a Markov chain, some Markov chain models, First Step Analysis, some special Markov chains, Functionals of Random Walks and Success runs
 Unit II : Long run behaviour of Markov chains - Regular Markov chains - Transition probability matrices – Examples, Classification of states, Basic limit theorem of Markov chains, Reducible Markov chains
 Unit III : Poisson Processes - Poisson distribution and Poisson Processes, Law of rare events, distributions associated with Poisson Processes, Uniform Distribution and Poisson Processes, Spatial Poisson Processes, Compound and Marked Poisson Processes
 Unit IV : Continuous time Markov chains - Pure birth processes – Pure Death processes, Limiting behaviour of birth and death Processes, birth and death Processes with absorbing states , Finite state Continuous time Markov chains, A Poisson Process with a Markov intensity
 Unit V : Renewal phenomena – Definitions, examples, the Poisson Process viewed as a renewal process

MSI E007	Representation Theory of Finite Groups	2	1	0	3	S.Parvathi
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Course Objective:
 To highlight the importance of combination of techniques used from group theory,ring theory and linear algebra
 To motivate the students for further study

Unit I : Classical groups: General linear group , Orthogonal group, Symplectic group, Unitary group.
 Unit II : Group representation, conjugate representation, G-invariant spaces - irreducible representations - Schur’s lemma
 Unit III : The Group Algebra - Maschke’s theorem - characters. Orthogonality relations for characters – Number of irreducible representations

Unit IV : Permutation representations - Regular representation. Representations of Symmetric groups
 Unit V : Representation of Finite abelian groups - Dihedral groups.

MSI E008	Graph Theory	2	1	0	3	M.Loganathan
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Pre-requisite: Undergraduate Level Mathematics.

Unit I : Graphs – Vertex degrees - Sub-graphs - Paths and cycles - Connected graphs - Connected components
 Unit II : A cyclic graphs – Trees - Cut edges - Cut vertices – Spanning Tree .
 Unit III : Euler tours - Euler graphs - Hamiltonian paths - Hamiltonian graphs - Closure of a graph.
 Unit IV : Planar graphs - Euler’s formula- Vertex colouring - Chromatic number - Chromatic polynomial – R - Critical graphs.
 Unit V : Edge colouring - Edge Chromatic number - Dual of a plane graph -Map colouring - Four and five colour theorems.

MSI E009	Lie Groups of Transformations and Ordinary Differential Equations	2	1	0	3	R.Sahadevan
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Pre-requisite: MSI 1003 and 1004

Course Objective:

To introduce for advanced research in mathematics and applications of Lie group.

Unit I : Introduction - Lie groups of transformations - infinitesimal transformations.
 Unit II : Extended group transformations and infinitesimal transformations (one independent and one dependent variables).
 Unit III : Lie Algebras and applications.
 Unit IV : Invariance of first and second order ordinary differential equations.

MSIE010	Lie Groups of Transformations and Partial Differential Equations	2	1	0	3	R.Sahadevan
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Unit I : Introduction - Lie groups of transformations - infinitesimal transformations.
 Unit II : Extended group transformations and infinitesimal transformations.
 Unit III : Invariance of a partial differential equations of first and second order - elementary examples.
 Unit IV : Noether's theorem and Lie Backlund symmetries.

MSIE011	Fourier Analysis	2	1	0	3	K.Parthasarathy
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Pre-requisite: MSI 1001 and MSI 2003.

Unit I : Fourier series : Fourier coefficients - Fourier series of square summable functions and summable functions.
 Unit II : Pointwise, absolute and norm convergence of Fourier series - some applications.
 Unit III : Fourier integrals : Fourier transforms for L1 functions - rapidly decreasing functions.
 Unit IV: L2 theory - differentiation and Fourier transforms - spherical harmonics - some applications.

MSI E012	Potential Theory in R^n	2	1	0	3	Premalatha Kumaresan
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Pre-requisite: MSI 2003

Unit I : Harmonic functions - Dirichlet problem.
 Unit II : Functions harmonic on a ball - Directed families of harmonic functions.
 Unit III : Super harmonics functions – Equivalent definitions - Minimum principle.
 Unit IV : Properties of Super harmonic functions
 Unit V : Directed families of super harmonic functions – Properties of surface and volume mean values.

MSI E013	Linear Lie Groups	3	0	0	3	K.Parthasarathy
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Unit I : Linear Lie Groups: Definition and examples, the exponential map and the Lie algebra of a linear Lie groups.
 Unit II : The Lie Correspondents, Homomorphisms.
 Unit III : Basic Representation Theory, irreducible representations of SU(2) and SO(3).
 Unit IV : Characters, Orthogonality and Peter-Weyl Theorem.
 Unit V : Roots, Weights and Weyl’s Formulas.

MSI E014	Banach Algebras and Operator Theory	3	0	0	3	Agrawal Sushama N.
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Unit I : Banach Algebras definition, examples, ideals and quotients, invertibility and the Spectrum, Banach – Mazur theorem.

Unit II : Spectral radius formula, Gelfand theory of commutative Banach Algebras.

Unit III : C^* - Algebras, Selfadjoint, normal, unitary operators on a Hilbert space, Projectors.

Unit IV : Gelfand – Naimark Theorem for commutative C^* - algebras, continuous functional Calculus for normal operators, Positive Operators and Square root.

Unit V : Borel functional Calculus for normal operators, Spectral measures, Spectral Theorem for bounded normal operators.

MSI E015	Commutative Algebra	2	1	0	3	S.Parvathi
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Pre-requisite: MSI 1001 and 1002

Course Objective:

To provide basic understanding of Commutative Algebra Links: To algebraic number theory, algebraic geometry and advanced level commutative algebras

Unit I : Modules over principal ideal rings

Unit II : Roots of unity - Finite fields – integral Elements over a ring - Integrally closed rings- algebraic elements over fields - Algebraic extensions – conjugate elements – conjugate fields- integers in quadratic fields

Unit II : Norms and traces – the discriminant- the terminology of number fields - cyclotomic fields

Unit IV : Noetherian rings and modules – an application concerning integral elements - Some preliminaries concerning ideals

Unit V : Dedekind rings- the norm of an ideal

M.Sc.STATISTICS

Subject Code	Title of the Course	Core/ Elective	L	T	P	C
I SEMESTER						
MSI C101	Real Analysis	C	2	1	0	3
MSI C102	Linear Algebra	C	2	1	0	3
MSI C103	Distribution Theory	C	3	1	0	4
MSI C104	Measure Theory	C	3	1	0	4
	Elective 1	E	3	0	0	3
II SEMESTER						
MSI C105	Probability Theory	C	3	1	0	4
MSI C106	Sampling Theory	C	3	1	0	4
MSI C107	Statistical Estimation Theory	C	3	1	0	4
MSI C108	Practical – I (Calculator Based)	C	2	0	0	2
	Elective 2	E	3	0	0	3
	Elective 3	E	3	0	0	3
III SEMESTER						
MSI C109	Multivariate Analysis	C	3	1	0	4
MSI C110	Testing Statistical Hypotheses	C	3	1	0	4
MSI C111	Design & Analysis of Experiments	C	3	1	0	4
	Elective 4	E	3	0	0	3
	Elective 5	E	3	0	0	3
IV Semester						
MSI C112	Statistical Quality Management	C	3	1	0	4
MSI C113	Practical – II (Calculator Based)	C	0	0	2	2
MSI C114	Practical – III (Software Based)	C	0	0	2	2
MSI C115	Project Work / Dissertation	C	0	6	0	6
	Elective 6	E	3	0	0	3

B – ELECTIVE COURSES

Subject Code	Title of the Course	L	T	P	C
MSI E101	Operations Research	3	0	0	3
MSI E102	Actuarial Statistics	3	0	0	3
MSI E103	Statistical Genetics	3	0	0	3
MSI E104	Markov Chain and its Applications	3	0	0	3
MSI E105	Reliability and Survival Analysis	3	0	0	3
MSI E106	Statistical Methods for Epidemiology	3	0	0	3
MSI E107	Stochastic Modeling	3	0	0	3
MSI E108	Non parametric inference	3	0	0	3
MSI E109	Data Mining Tools	3	0	0	3
MSI E110	Bayesian Inference	3	0	0	3
MSI E111*	Statistics for Social Sciences	3	0	0	3
MSI E112 *	Bio-Statistics	3	0	0	3

* TO OTHER DEPARTMENTS ONLY

MSI C101	Real Analysis	C	2	1	0	3	Guest Faculty
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Pre-requisite : Undergraduate level Mathematics.

Unit I : Recap of elements of set theory; introduction to real numbers, introduction to n-dimensional Euclidian space; open and closed intervals (rectangles), compact sets, Bolzano – Weirstrass theorem, Heine – Borel theorem.

Unit II : Sequences and series; their convergence. Real valued functions, continuous functions; uniform continuity, sequences of functions, uniform convergence ; power series and radius of convergence.

Unit III : Differentiation, maxima – minima of functions; functions of several variables, constrained maxima – minima of functions.

Unit IV : Riemann integral & Riemann – Stieltjes integral with respect an increasing integrator – properties of R.S. integral –integrators of bounded variation.

Unit V : Multiple integrals and their evaluation by repeated integration, change of variables in multiple integration. Uniform convergence in improper integrals, differentiation under the sign of integral – Leibnitz rule.

MSI C102	Linear Algebra	C	2	1	0	3	Ms. M.R. Sindhumol
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Pre-requisite : Undergraduate level Mathematics.

Unit I : Vector spaces, Linear dependence, linear independence, basis and diversion of vector space, inner product Gram Schmidt orthogonalization, linear transformations, projection operators, null space and nullity.

Unit II : Matrix algebra, rank and inverse of a matrix, determinants, characteristic roots, characteristic polynomial, Cayley Hamilton theorem, multiplicity of characteristic roots, idempotent matrix.

Unit III : Reduction of matrices, Echelon form, Hermite canonical form, diagonal reduction, rank factorization, triangular reduction Jordan form, pairs of symmetric matrices, singular value decomposition, spectral decomposition.

Unit IV : Kronecker product of matrices matrix differentiation, generalized inverse, Moore-Penrose inverse and properties of g-inverse, Application of g-inverse.

Unit V : Quadratic forms, classification, definiteness, index and signature, extremum of quadratic forms, reduction of quadratic form, transformation, applications of quadratic forms.

MSI C103	Distribution Theory	C	3	1	0	4	Dr. P.Dhanavanthan
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Pre-requisite : Undergraduate level Mathematics.

Unit I : Brief review of distribution theory, functions of random variables and their distributions using Jacobian of transformation, Laplace and Cauchy distribution, lognormal distribution, gamma, logarithmic series.

Unit II : Bivariate normal, Bivariate exponential, Bivariate Poisson, Compound, truncated and mixture of distributions, concepts of convolution.

- Unit III : Sampling distributions, non-central chi-square distribution, t and F distributions and their properties, distributions of quadratic forms under normality and related distribution theory – Cochran’s and James theory.
- Unit IV : Order statistics their distributions and properties, Joint and marginal distributions of order statistics, extreme value and their asymptotic distributions, approximating distributions of sample moment, delta method.
- Unit V : Kolmogorov Smirnov distributions, life distributions, exponential, Weibull and extreme value distributions Mills ratio, distributions classified by hazard rate.

MSI C104	Measure Theory	C	3	1	0	4	Dr. G.Gopal/Guest Faculty
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Pre-requisite : Undergraduate level Mathematics.

- Unit I : Sets and set functions, Algebra of sets, limits of sequence of sets, classes of sets : Ring, Field, Field and monotone classes, Generated classes.
- Unit II : Measure functions, properties of measure functions, Outer measure, extension and completion of measures signed measures, Hahn Decomposition theorem.
- Unit III : Lebesgue, Stieltjes measures, examples, measurable functions, approximation theorems.
- Unit IV : Measure integration, properties of measure integrals, Monotone convergence theorem and dominated convergence theorem, Fatou’s lemma.
- Unit V : Absolute continuity, Radon Nikodym theorem, singularity, Lebesgue Decomposition theorem, Fubini’s theorem, convergence types for measurable functions (almost everywhere, in mean and their inter-relationships).

MSI C105	Probability Theory	C	3	1	0	4	Dr.G.Gopal/ Guest Faculty
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Pre-requisite : Measure Theory.

- Unit I : Events, sample space, different approaches to probability, random variables and random vector, Distribution functions of random variables and random vector, Expectation and moments, basic, Markov, Chebyshev’s, Holder’s, Minkowski’s and Jensen’s inequalities.
- Unit II : Independence of sequence of events and random variables, conditional probability, conditional expectation, smoothing properties, Tail-sigma field, 0-1 law of Borel and Kolmogorov, Hew itt-Savage 0-1 law.
- Unit III : Characteristic functions and their properties, inversion formula, convergence of random variables, convergence in probability, almost surely, in the r-th mean and in distribution, their relationships, convergence of moments, Helly-Bray theorem, continuity theorem and convolution of distributions.
- Unit IV : Convergence of series of random variables, three-series theorem, Khintchine weak law of large numbers, Kolmogorov inequality, strong law of large numbers.
- Unit V : Central limit theorem, statement of CLT, Lindeberg, Levy and Liapounov forms with proof and Lindeberg Feller’s form examples.

MSI C106	Sampling theory	C	3	1	0	4	Dr.M.R.Srinivasan
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Pre-requisite : Undergraduate level Mathematics.

- Unit I : Review of basic finite population sampling techniques SRS, Stratified, Systematic sampling, related results on estimation, allocation problem in stratification sampling, efficiency of systematic over stratified and SRS.
- Unit II : Varying probabilities, PPS WR/WOR ordered and un-ordered estimator, selection of samples Horowitz Thompson, Desraj, Rao Hartley-Cochran estimators.
- Unit III : Sampling with supplementary information, Ratio and regression estimators and related results.
- Unit IV : Multi stage and multiphase sampling, two stage sampling with equal number of second stage under-double sampling cluster sampling.
- Unit V : Non sampling errors, errors in surveys (Types of Errors), Observational errors (Measurement and related results, Incomplete samples (Non-response Politz and summary randomized response technique, Introduction to Jackknife and bootstrap techniques.

MSIC107	Statistical Estimation Theory	C	3	1	0	4	Dr.G.Gopal
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Pre-requisite : Probability Theory.

- Unit I : Sufficient statistics, Neyman, Fisher Factorisation theorem, the existence and construction of minimal sufficient statistics, Minimal sufficient statistics and exponential family, sufficiency and completeness, sufficiency and invariance.

- Unit II : Unbiased estimation : Minimum variance unbiased estimation, locally minimum variance unbiased estimators, Rao Blackwell – theorem. Completeness- Lehmann Scheffe theorems, Necessary and sufficient condition for unbiased estimators
- Unit III : Cramer- Rao lower bound, Bhattacharya system of lower bounds in the 1-parameter regular case. Chapman -Robbins inequality.
- Unit IV : Maximum likelihood estimation, computational routines, strong consistency of maximum likelihood estimators, Asymptotic Efficiency of maximum likelihood estimators, Best Asymptotically Normal estimators, Method of moments.
- Unit V : Bayes' and minimax estimation : The structure of Bayes' rules, Bayes' estimators for quadratic and convex loss functions, minimax estimation, interval estimation.

MSI C108	Practical – I (Calculator Based)	C	2	0	0	2	All Faculty
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MSI C109	Multivariate Analysis	C	3	1	0	4	Dr.P.Dhanavanthan
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Pre-requisite : Distribution theory.

- Unit I : Random sampling from a multivariate normal distribution. Maximum likelihood estimators of parameters. Distribution of sample mean vector. Wishart matrix – its distribution and properties. Distribution of sample generalized variance.
- Unit II : Null and non-null distribution of simple correlation coefficient. Null distribution of partial and multiple correlation coefficient. Distribution of sample regression coefficients. Application in testing and interval estimation. Distribution of sample intra – class correlation – coefficient in a random sample from a symmetric multivariate normal distribution. Application in testing and interval estimation.
- Unit III : Null distribution of Hotelling's T^2 statistics. Application in tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in a multivariate normal population.
- Unit IV : Multivariate linear regression model – estimation of parameters, tests of linear hypotheses about regression coefficients. Likelihood ratio test criterion. Multivariate Analysis of variance (MANOVA) of one-and two-way classified data.
- Unit V : Classification and discrimination procedures for discrimination between two multivariate normal populations – sample Discriminant function, tests associated with Discriminant functions, probabilities of misclassification and their estimation, classification into more than two multivariate normal populations. Principal components, Dimension reduction, Canonical variables and canonical correlation – definition, use, estimation and computation.

MSI C110	Testing Statistical Hypotheses	C	3	1	0	4	Dr.G.Gopal
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Pre-requisite : Probability Theory .

- Unit I : Uniformly most powerful tests, the Neyman-Pearson fundamental Lemma, Distributions with monotone likelihood ratio.Problems
- Unit II : Generalization of the fundamental lemma, two sided hypotheses, testing the mean and variance of a normal distribution.
- Unit III : Unbiased ness for hypotheses testing, similarly and completeness, UMP unbiased tests for multi parameter exponential families, comparing two Poisson or Binomial populations, testing the parameters of a normal distribution (unbiased tests), comparing the mean and variance of two normal distributions.
- Unit IV : Symmetry and invariance, maximal invariance, most powerful invariant tests.
- Unit V : SPRT procedures, likelihood ratio tests, locally most powerful tests, the concept of confidence sets, non parametric tests.

MSI C111	Design and Analysis of Experiments	C	3	1	0	4	Dr.M.R.Srinivasan
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Pre-requisite : Matrix algebra & Linear models.

- Unit I : Linear models, classification, linear estimators, Gauss-Markov theorem, BLUE, test of general linear hypothesis, fixed, mixed and random effects models.
- Unit II : Review of basic designs: CRD, RBD, LSD, Orthogonal latin squares, Hyper Graeco Latin squares – analysis of variance – analysis of covariance – multiple comparisons – multiple range tests - Missing plot technique – general theory and applications.
- Unit III : General factorial experiments, factorial effects; best estimates and testing the significance of factorial effects ; study of 2 and 3 factorial experiments in randomized blocks; complete and partial confounding. Fractional replication for symmetric factorials. Strip plot and split block experiments.
- Unit IV : General block design and its information matrix (C), criteria for connectedness, balanced and orthogonality; intrablock analysis (estimability, best point estimates / interval estimates of estimable

linear parametric functions and testing of linear hypotheses) : BIBD – recovery of interblock information; Youden design – intrablock analysis.

Unit V : Response surface methodology - first order and second order rotatable designs, applications: clinical trials.

MSIC112	Statistical Quality Management	C	3	1	0	4	Ms.M.R.Sindhumul
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Pre-requisite : Undergraduate level Statistics.

Unit I : Concept of quality – definition and standardization of quality – Functional elements of TQM, quality movements in India, quality circle, quality audit, Direct and indirect quality costs, measurement and analysis – Pareto and Ishikawa diagrams, ISO 9000 series.

Unit II : General theory and review of control charts for attribute and variable data; O.C. and A.R.L. of control charts; Moving average and exponentially weighted moving average charts; Cu-sum charts using V-masks and Economic design of X-bar chart.

Unit III : Acceptance sampling plans for attribute inspection ; single, double and sequential sampling plans and their properties. Plans for inspection by variables for one-sided and two-sided specifications; Mil-Std and IS plans.

Unit IV : continuous sampling plans for Dodge type and Wald-Wolffwitz type and their properties, chain sampling plan..

Unit V : Capability indices Cp, Cpk and Cpm; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics. Use of Design of Experiments in SPC, factorial experiments.

MSI C113	Practical – II (Calculator Based)	C	2	0	0	2	All Faculty
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MSI C114	Practical – I (Software Based)	C	2	0	0	2	All Faculty
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Use Statistical packages like SPSS, MINITAB, S-PLUS for solving statistical problems in Core and Electives. Exercises will be prepared by the faculty incharge.

ELECTIVES

MSIE101	Operations Research		3	0	0	3	Dr.P.Dhanavanthan
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Pre-requisite : Open to all – Offered in the First Semester.

Unit I : Linear programming – Simplex and Revised simplex method. Duality in LPP – sensitivity Analysis – Bounded variable Techniques – parametric and integer programming problems – Game theory – different methods of solving game problems.

Unit II : Application of LPP – Transportation problem – Assignment problem – characteristic of queuing model – M/M/1 and M/M/C queuing model.

Unit III : Network analysis- PERT and CPM-Simulation- Monte-Carlo Techniques.

MSI E102	Actuarial Statistics		3	0	0	3	Guest Faculty
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Pre-requisite : Open to all – Offered in the Second Semester

Unit I : Mortality : Gompertz - Makeham laws of mortality - life tables.

Annuities : Endowments, Annuities, Accumulations, Assurances, Family income benefits.

Unit II : Policy Values : Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

Unit III : Contingent Functions : Contingent probabilities, assurances. Decrement tables.

Pension funds : Capital sums on retirement and death, widow's pensions, benefits dependent on marriage.

MSI E103	Statistical Genetics		3	0	0	3	Dr.M.R.Srinivasan
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Unit I : Bio-assays - response relationship - Transformation - probit and logits - Feller's theorem. Symmetric and Asymmetric assays.

Unit II : Mating designs - random mating - Hardy and Weinberg equilibrium. Inbreeding - segregation and linkage analysis.

Unit III : Estimation of gene frequencies - inheritance - heritability- repeatability - selection index - diallel and triallel crosses.

MSI E104	Markov Chain and its Applications	3	0	0	3	Dr.P.Dhanavathan
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Unit I : Markov Chains – classification of states, Determination of higher order transition probabilities, stability of a Markov system, limiting behavior.

Unit II : Kolmogorov forward and backward differential equations. Poisson processes - birth and death processes and applications.

Unit III : Branching process and its applications.

MSI E105	Reliability and Survival Analysis	3	0	0	3	Dr.G.Gopal
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Unit I : Concepts of censoring, likelihood in these cases, life distributions-exponential Weibull, Gamma, Lognormal, Pareto, Linear failure rate, estimation/testing under censoring setup.

Unit II : Life tables, failure rate, mean residual life and their elementary properties. Estimation of survival functions-actuarial estimator, Kaplan-Meier estimator, properties.

Unit III : Cox proportional hazards regression models with one and several covariates, exponential, Weibull, lognormal regression.

MSI E106	Statistical Methods for Epidemiology	3	0	0	3	Dr.M.R.Srinivasan
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Unit I : Measures of disease frequency : Mortality / morbidity rates, incidence rates, prevalence rates. Source of mortality / morbidity statistics – hospital records, vital statistics records. Measures of secrecy or validity : sensitivity index, specificity index. Measure of reliability. Epidemiologic concepts of diseases : Factors which determine the occurrence of diseases, models of transmission of infection, incubation period, disease spectrum and herd immunity.

Unit II : Observational studies in Epidemiology : Retrospective (case control) & prospective (cohort or longitudinal) studies. Measures of association : Relative risk, attributable risk. Statistical techniques used in analysis : Cornfield and Gart method, Mantel – Haenszel method. Conditional and unconditional matching. Analysis of data from matched samples, logistic regression approach. Experimental Epidemiology : Clinical and community trials Statistical techniques: Methods for comparison of two treatments. Crossover design with Gart and McNemars test. Randomization in a clinical trials, sequential methods in clinical trials, clinical life tables, assessment of survivability in clinical trials.

Unit III : Mathematical modeling in Epidemiology : (deterministic and stochastic) simple epidemic model, generalized epidemic model, Read-Frost and Green-wood models, models for carrier borne and host vector diseases. Estimation of latent and infectious periods, geographical spread of the disease, simulation of an epidemic.

MSI E107	Stochastic Modelling	3	0	0	3	Dr.G.Gopal
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Unit I : Basic concepts of Stochastic Processes and their classifications - Markov chain and its applications - Markov processes and applications.

Unit II : Time Series models : Concepts, analysis and applications. Gauss Weiner processes - Levy processes. Brownian Motion.

Unit III : Monte Carlo simulations of stochastic processes.

MSI E108	Non parametric Inference	3	0	0	3	Dr.M.R.Srinivasan
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Unit I : Rank tests for comparing two treatments, Wilcoxon ranksum tests, Asymptotic null distribution of Wilcoxon statistics, Siegel-Tukey and Smirnov tests, power of Wilcoxon rank, sum tests, Asymptotic power, comparison with students t-test, estimating the treatment effect.

Unit II : Block comparison for two treatments, sign test for paired comparisons, Wilcoxon signed rank test, a balanced design for paired comparisons, power of sign and Wilcoxon signed rank tests and their comparisons.

Comparison of more than two treatments, the Kruskal, Wallis test, 2 x t contingency table, comparing several treatments with a control, ranking several treatments.

Unit III : Randomised complete blocks, Friedman, Cochran, McNemar tests, Aligned ranks. Tests of randomness and independence, testing against, trend, testing for independence, zxt contingency tables.

MSI E109	Data Mining Tools	3	0	0	3	Ms.M.R.Sindhumul
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Unit I : Classification and clustering methods, decision trees.

Unit II : Introduction to databases, data warehouse, online analytical processing.

Unit III : Association rules, neural networks, regression models and trees.

MSI E110	Bayesian Inference	3	0	0	3	Guest Faculty
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Unit I : Bayesian point estimation : as a prediction problem from posterior distribution. Bayes estimators for (i) absolute error loss (ii) squared error loss (iii) 0-1 loss. Generalization to convex loss functions. Evaluation of the estimate in terms of the posterior risk. theorem – prior and posterior distributions. Conjugate priors and Jeffrey’s priors, examples.

Unit II : Bayesian interval estimation : Credible intervals. Highest posterior density regions. Interpretation of the confidence coefficient of an interval and its comparison with the interpretation of the confidence coefficient for a classical confidence interval.

Unit III : Bayesian testing of hypotheses : Specification of the appropriate form of the prior distribution for a Bayesian testing of hypothesis problem. Prior odds, Posterior odds, Bayes factor for various types of testing hypothesis problems depending upon whether the null hypothesis and the alternative hypothesis are simple or composite.

MSI E111	Statistics for Social Sciences	3	0	0	3	Dr.G.Gopal / Dr.P.Dhanavanthan
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Unit I : Measures of central tendency and dispersion - coefficient of variation. Elements of probability theory - Bayes theorem. Random variables - standard distributions and their properties, Binomial, Poisson, Uniform, Normal Distributions.

Unit II : Elements of sampling theory - Simple and stratified and systematic sampling schemes. Multiple correlation and Regression, Partial linear and Regression, Correlation and regression - Rank Correlation.

Unit III : Tests of significance based on Normal t, Chi square and F distributions. ANOVA - one-way and two-way classifications.

MSI E112	Bio-Statistics	3	0	0	3	Dr.M.R.Srinivasan/ Ms.M.R.Sindhumol
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Unit I : Frequency distribution - Diagrammatic representation - Measures of Central tendency - Dispersion - Probability - Probability distribution - Binomial, Poisson & Normal Distribution.

Unit II : Elements of sampling theory – Simple, stratified and systematic sampling schemes. Applications in Biology Correlation and Regression, Rank Correlation. Multiple correlation and Regression, Partial correlation.

Unit III : Large Sample test - Small sample test - Student ‘t’, ‘F’ tests - Chi-Square test for independence and Goodness of fit - Analysis of Variance. Non parametric Tests - Sign test, Run test, Median test, Two Sample Rank test.

M.Sc. ACTUARIAL SCIENCE

Subject Code	Title of the Course	C/E	L	T	P	C
I SEMESTER						
MSI C201	Probability Theory	Core	3	1	-	4
MSI C202	Financial Mathematics – I	Core	3	1	-	4
MSI C203	Probability Distributions	Core	3	1	-	4
	Elective	Elective	1	-	1	2
	Elective	Elective	2	1	-	3
II SEMESTER						
MSI C204	Survival Models	Core	3	1	-	4
MSI C205	Statistical Inference	Core	3	1	-	4
MSI C206	Financial Mathematics – II	Core	3	1	-	4
	Elective	Elective	2	1	-	3
	Elective	Elective	2	-	1	3
MSI C207	Computational Laboratory – I	Core	--	-	2	2
III SEMESTER						
MSI C208	Actuarial Mathematics – I	Core	3	1	-	4
MSI C209	Stochastic Modeling	Core	3	1	-	4
MSI C210	Risk Models	Core	3	1	-	4
	Elective	Elective	2	1	-	3
	Elective	Elective	1	1	-	2

IV SEMESTER						
MSI C211	Actuarial Mathematics – II	Core	3	1	-	4
MSI C212	Corporate Financial Management	Core	3	1	-	4
MSI C213	Computational Laboratory – II	Core	-	-	2	2
	Elective	Elective	2	1	-	3
MSI C214	Project / Internship + Seminar (100+100)/2	Core	-	-	5+1	5+1

MSI C201	Probability Theory	Core	3	1	-	4
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Objectives :

To provide a fundamental aspects of probability concepts.

To gain confidence to apply the probabilistic techniques and tools to industrial and Actuarial problems.

Pre-requisite :

UG level Algebra and Calculus.

Course outline :

- Unit 1 : Sample space – events. Random variables – distribution functions and its properties – moments – expectation – variance – conditional probability – Baye’s theorem – computational probabilities – simple problems from Industrial and Actuary.
- Unit 2 : Moment generating function – pgf – cumulant generating functions – evaluation of moment using these functions – functions of random variables – simple applications.
- Unit 3 : Characteristic functions – properties – inversion formulae – uniqueness theorem – moments problem – Levy Cramer theorems – simple problems.
- Unit 4 : Independence – pairwise and complete independence - convolution - conditional expectation - smoothing properties – Martingales – simple problems.
- Unit 5 : Laws of large numbers weak and strong law of large numbers – simple applications – central limit theorems (iid and id) – normal approximation – simple applications.

MSI C202	Financial Mathematics – I	Core	3	1	-	4
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Objectives :

To provide fundamentals of financial mathematics.

Pre-requisite : UG level Algebra and Calculus

Course outline :

- Unit 1 : Rates of interest – Simple and Compound interest rates –Effective rate of interest - Accumulation and Present value of a single payment – Nominal rate of interest – Constant force of interest δ - Relationships between these rates of interest - Accumulation and Present value of single payment using these rates of interest – accumulation and present value of a single payment using these symbols - when the force of interest is a function of t, $\delta(t)$. Definition of $A(t_1, t_2)$, $A(t)$, $v(t_1, t_2)$ and $v(t)$. Expressing accumulation and present value of a single payment using these symbols - when the force of interest is a function of t, $\delta(t)$.
- Unit 2 : Series of Payments(even and uneven) - Definition of Annuity(Examples in real life situation) – Accumulations and Present values of Annuities with level payments and where the payments and interest rates have same frequencies - Definition and Derivation of $a_{\overline{n}|}$, $s_{\overline{n}|}$, $\ddot{a}_{\overline{n}|}$, $\ddot{s}_{\overline{n}|}$, Definition of Perpetuity and derivation for $a_{\overline{\infty}|}$ and $\ddot{a}_{\overline{\infty}|}$ -Examples - Accumulations and Present values of Annuities where payments and interest rates have different frequencies. Definition and derivation of $a_{\overline{n}|}^{(p)}$, $\ddot{a}_{\overline{n}|}^{(p)}$, $s_{\overline{n}|}^{(p)}$, $\ddot{s}_{\overline{n}|}^{(p)}$
- Unit 3 : Increasing and Decreasing annuities – Definition and derivation for $(Ia)_{\overline{n}|}$, $(Is)_{\overline{n}|}$ and $(Da)_{\overline{n}|}$ - Annuities payable continuously - Definition and derivation of $\overline{a}_{\overline{n}|}$, $(\overline{Ia})_{\overline{n}|}$, $\overline{s}_{\overline{n}|}$, $(\overline{Is})_{\overline{n}|}$ - Annuities where payments are increasing continuously and payable continuously – definition and derivation of $(\overline{Ia})_{\overline{n}|}$, $(\overline{Is})_{\overline{n}|}$.
- Unit 4 : Loan schedules – Purchase price of annuities net of tax – Consumer credit transactions

Unit 5 : Fixed interest securities – Evaluating the securities – Calculating yields – the effect of the term to redemption on the yield – optional redemption dates – Index linked Bonds – evaluation of annuities subject to Income Tax and capital gains tax.

MSI C203	Probability Distributions	Core	3	1	-	4
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Objectives :

On completion of this course the students will be able to understand the probability distributions and their applications to Industrial and Actuarial problems.

Pre-requisite : UG level Calculus

Course outline :

Unit 1 : Discrete distributions – Binomial – Poisson – Multinomial – Hyper geometric – Geometric – discrete uniform – their characteristics and simple applications.

Unit 2 : Continuous distributions – Uniform - Normal – exponential – Gamma – Weibull – Pareto – lognormal – Laplace – logistic distributions – their characteristics and applications.

Unit 3 : Bivariate and Multivariate Normal – Compound and truncated distributions – convolutions of distributions.

Unit 4 : Sampling distributions t , χ^2 and F distributions and their interrelations and characteristics – order statistics and their distribution – distribution of sample and mid range.

Unit 5 : Applications of multivariate – normal distributions – principal components analysis – discriminant analysis – factor analysis – cluster analysis – Canonical correlations.

MSI C204	Survival Models	Core	3	1	-	4
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Objectives :

To provide fundamentals in survival models and develop skills to apply to industrial and actuarial situations.

Pre-requisite : MSI C201 MSI C203

Course outline :

Unit 1 : Concept of Survival Models

Unit 2 : Estimation procedures of Life time Distributions – Cox Regression model – Nelson and Aalen Estimates

Unit 3 : Two state Markov Model

Unit 4 : Multi state Markov Models - Statistical Models of transfers between multiple states, Derivation of relationships between probabilities of transfer and transition intensities. Maximum Likelihood Estimators(MLE) for the transition intensities in models of transfers between states with piecewise constant transition intensities.

Unit 5 : Binomial and Poisson models of mortality – MLE for probability of death – Comparison with Multi state models.

MSI C205	Statistical Inference	Core	3	1	-	4
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Objectives :

Only applicational outstanding of basic concepts, main theorem, methods and underlying conditions are required to be emphasised. After going through this course the student shall be able to identify the appropriate method of inference after verifying the validity of the conditions which these methods demand.

Pre-requisite : MSI C201, MSI C203

Course outline :

Unit 1 : Estimation Methods : Properties of a good estimator – unbiasedness – efficiency – Cramer Rao bound – sufficiency – Methods of estimation – Methods of moments – Maximum likelihood method – minimum chisquare – method of least squares and their properties.

Unit 2 : Neyman Pearson theory of testing of hypothesis UMP and UMPU tests – chisquare tests – locally most powerful tests – large sample tests – testing linear hypothesis.

Unit 3 : Non parametric inference :

The Wilcoxon signed rank test – The Mann-Whitney – Wilcoxon Rank sum test – the runs test – chisquare test of goodness of fit test – Kolmogorov-Smirnov goodness of fit test – Kruskal Wallies test – Friedman test .

- Unit 4 : Confidence sets and intervals – exact and large sample confidence intervals – shortest confidence intervals.
- Unit 5 : Elements of Bayesian inference – Bayes theorem – prior and posterior distribution – conjugate and Jeffreys priors – Bayesian point estimation – minimax estimation – loss function – confluent loss functions – Bayesian interval estimation and testing of hypothesis.

MSI C206	Financial Mathematics – II	Core	3	1	-	4
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Objectives :

To provide fundamentals in financial transactions, discounting, repayments, term structure, derivatives and stochastic interest rate models.

Pre-requisite : MSI C206

Course outline :

- Unit 1 : Investment Project Appraisal – Discounted Cash flow techniques.
- Unit 2 : Investment and Risk characteristics of different types of Assets for Investment for investment purposes
- Unit 3 : Delivery price and the value of a Forward contract using arbitrage free pricing methods
- Unit 4 : Term structures of interest rates
- Unit 5 : Simple Stochastic interest rate Models

MSI C207	Computational Laboratory – I	Core	--	-	2	2
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Objectives :

The implementation of standard numerical algorithms are mastered and results are calculated with precision. The strengths and limits of each algorithm are understood as well as which technique is most suitable for a given problem. Lab time is used to master code writing in C++ .

C++ Programming Exercises

Mathematical Exercises : Algebraic equations -Bisections method- Secant method- Newton-Raphson method- System of linear equations -2.1 Gaussian Elimination- 2.2 Gauss-Seidal Iteration-Gauss- Jordan Iteration- Matrix operations -Interpolation and curve Fitting-Lagrange Interpolation- Newton polynomials- Straight line fitting- Curve fitting-Numerical differentiation and integration
 Differentiation- Trapezoidal and Simpson's 1/3 rule -Solution to differential equations-Euler method- Runge – Kutta method of order 2- Runge – Kutta method of order 3- Predictor – corrector method-Statistical Exercises- Statistical Methods- Formation of frequency distribution- Calculation of moments – mean and variance- Computation of correlations and regression coefficients
 Fitting and probability distributions- ANOVA (one-way, two-way) -Tests of significance based on t, χ^2 and F.- Inference-Method of moments- Method of maximum likelihood- Confidence intervals based on t, χ^2 and F.- MP test.

MSI C208	Actuarial Mathematics – I	Core	3	1	-	4
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Objectives :

To provide basic knowledge in mathematical techniques which are of particular relevance to actuarial work in life-insurance, health care and pensions.

Pre-requisite : Admission to this Master's programme.

Course outline :

- Unit 1 : Definition of Exposed to risk – Estimation of transition intensities depending on age only using Direct method and Census method.
- Unit 2 : Simple Assurance and Annuity contracts – Mean and variance of the present value of the payments under these contracts assuming constant deterministic interest rates – Expected present values and variances of simple benefits by table look-up or by using life tables. Calculation of Net premium Gross Premium for fixed and variable benefits.
- Unit 3 : Paid-up values and Reserves – Prospective and Retrospective reserves – Continuous Reserves – Bonus and future expenses required for pricing and reserving and the influence of inflation on these.
- Unit 4 : Techniques of Discounted emerging costs, for use in pricing, reserving and assessing profitability, for all contract types and for pensions.
- Unit 5 : Description of the techniques of Asset shares in the context of life insurance contracts and the relationship of the asset share to the retrospective reserve – Calculation of the benefits on the early termination of a contract, including transfer, and the premium or benefits after a change in the terms of a contract.

MSI C209	Stochastic Modeling	Core	3	1	-	4
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Objectives :

To provide fundamentals of general principles of Stochastic Modelling. To lay strong theoretical foundation with potential applications to industrial and actuarial models.

Pre-requisite : MSI C201 MSI C203

Course outline :

- Unit 1 : Stochastic process : Definitions and classification (based on state space and time) of Stochastic Processes – various types of stochastic processes-.Markov chains : n-step TPM – classification states canonical representation of TPM – finite MC with transient states – No Claim Discount policy – Accident Proneness.
- Unit 2 : Irreducible Markov Chain with ergodic states : Transient and limiting behaviour – first passage and related results – applied Markov chains – industrial mobility of labor – Educational advancement – Human resource management – term structure – income determination under uncertainty – A Markov decision process.
- Unit 3 : Simple Markov processes : Markov processes – general properties – Poisson processes – Birth problem – death problem – birth and death problem – limiting distribution. Flexible manufacturing systems – stochastic model for social networks – recovery, relapse and death due to disease – Health, sickness and Death model – Martial status.
- Unit 4 : Stationary processes and time series – Stochastic models for time series – the auto regressive process – moving average process – mixed auto regressive moving average processes – time series analysis in the time domain – Box-Jenkins model for forecasting.
- Unit 5 : Brownian motion and other Markov processes – Hitting times – maximum variable – arc sine laws – variations of Brownian motion – stochastic integral – Ito and Levy processes – applications to Actuarial Science.

MSI C210	Risk Models	Core	3	1	-	4
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Objectives :

To develop ability to apply principles of Actuarial.

Pre-requisite : MSI C201 MSI 203

Course outline :

- Unit 1 : Concept of Decision theory and its applications – Concepts of Bayesian statistics – Calculation of Bayesian Estimators.
- Unit 2 : Calculate probabilities and moments of loss distributions both with and without simple reinsurance arrangements –Construct risk models appropriate to short term insurance contracts and calculate MGFs and moments for the risk models both with and without simple reinsurance arrangements. - Calculate and approximate the aggregate claim distribution for short term insurance contracts.
- Unit 3 : Explain the concept of ruin for a risk model – Calculate the adjustment coefficients and state Lundberg's inequality – Describe the effect on the probability of ruin of changing parameter values and of simple reinsurance arrangements.
- Unit 4 : Describe and apply the fundamental concepts of credibility theory – Describe and apply the fundamental concepts of simple experience rating systems – Describe and apply techniques for analyzing a delay(or run-off) triangle and projecting the ultimate position
- Unit 5 : Explain the fundamental concepts of a generalized linear model(GLM), and describe how a GLM may be applied.

MSI C211	Actuarial Mathematics – II	Core	3	1	-	4
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Objectives : To provide strong basis in mathematical techniques relevant to actuarial work in non-life insurance.

Pre-requisite : MSI C208, MSI C202

Course outline :

- Unit 1 : Exposed to risk with reference to Age and Duration
- Unit 2 : Graduation - Testing of crude estimates for consistency with a standard table or a set of graduated estimates – the process of Graduation
- Unit 3 : Selection and heterogeneity within the population – Ways in which selection can occur.
- Unit 4 : Process of population projection and its main determinants
- Unit 5 : Computational tools for use in determining the value of the benefits under a disability insurance contract.

MSI C212	Corporate Financial Management	Core	3	1	-	4
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Objectives :

The course focuses basic financial management in the corporate world. It will start with a module on foundations of finance, and then discuss capital budgeting/ corporate investment, capital structure, corporate sources of funding, dividend policy, financial planning including working capital management. The idea is to give a strong conceptual framework, while providing enough application insights. Prior knowledge of basic accounting will be an added advantage, but not essential.

Pre-requisite : MSI C209

Course outline :

Introduction and Overview of Corporate Finance

Unit 1 : Foundations of Finance : Time value of Money – NPV, IRR, and other Measures – Valuation of Common Stocks and Bonds.

Unit 2 : Investment Analysis : Modern theory of Finance – Capital Budgeting Decision Rule – Capital Budgeting and Cash Flow Analysis – Capital Budgeting and Risk.

Unit 3 : Capital Structure and Dividend Policy : Cost of Capital – Capital Structure and Financial Leverage – Determinants of Dividend Policy – Raising Capital.

Unit 4 : Financial Planning : Financial Statements and Ratio Analysis – Short-term Financial Decisions – Long-term Financial Decisions.

Unit 5 : Special Topics : Mergers and Acquisitions and Corporate Governance – Options and Corporate Finance.

MSI C213	Computational Laboratory – II	Core	-	-	2	2
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Objectives :

To provide exposure to Mathematical / Statistical software focusing more on writing source codes-.

To analyse the given data by identifying appropriate tools.

Data Analysis : Identifying the statistical tool and analysing the data using the appropriate tools.(S PLUS/ SAS)

Symbolic manipulation using MAPLE/ MATHEMATICA

Exercises based on the subjects taught in III & IV semesters.

(ie. Survival Analysis – Stochastic Models etc.)

Simulation study depending upon the requirement of the problem. (MATLAB)

MSI C214	Project / Internship + Seminar (100+100)/2	Core	-	-	5+1	5+1
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Objectives : To provide written, oral and visual presentation skills

To develop team work.

Course Outline :

Based on the interest of the students, they can choose their team and seminar topic. It can also an individual work. During the term, students will meet periodically the faculty to discuss different stages of the seminar. They are required to give three seminar presentations.

Project Work/ Internship :

Objectives :

To develop student's abilities to solve applied industrial and actuarial problems in a longer time frame than in usual in other courses. Students will learn how to search for known results and techniques related the project work. The students will present their project results as a written document and verbally.

Prerequisite : Completion of the course duration of first two semesters.

Course Outline :

The faculty will propose an array of problems in industrial / actuarial studies. Students may choose a problem from this list or propose of their own provided a faculty member / Guide approves it. This work may also be carried out as an internship programme. On completion of the project work, each student is expected to -Submit a written document describing the results, mathematical developments, background material, bibliographical search etc. -Present orally in a seminar setting of the work done in the thesis- Submit the software (if relevant) with appropriate documentation- The students will meet regularly with the project guide / adviser to work out problems that appear and adjust the goals and time frame accordingly.

OBJECT ORIENTED PROGRAMMING WITH C++

Objectives : To train in higher level language C++

Pre-requisite : Admission to this Master's programme

Course outline :

- Unit 1 : Principles of object oriented programming – beginning with C++ - Token, Expressions and Control structures.
- Unit 2 : Functions in C++ - Classes and objects.
- Unit 3 : Constructors and Destructors – operator overloading and type conversions
- Unit 4 : Inheritance : Extending classes – Pointers, Virtual Functions and Polymorphism.
- Unit 5 : Console I/O operations – working with files – object oriented systems development – Templates and Exception handling.

PRINCIPLES OF ECONOMICS

Objectives :

To provide strong foundation in fundamental concepts in economics to facilitate application of the same in the operation of insurance and financial systems. To provide sufficient understanding of macro economics so as to have in depth knowledge in future inflation returns on investment, stock market behaviour, exchange rates and economic growth.

Pre-requisite : Admission to this Master's programme

Course outline :

- Unit 1 : Market Mechanism – Supply and Demand interaction – Determination of equilibrium Elasticity of demand and Supply – Rational utility and consumption choice – Insurance system and its impact on Welfare.
- Unit 2 : Costs Revenue and output – Market structure – short and long run equilibrium in different markets – perfect competition, Monopoly, Monopolistic competition.
- Unit 3 : Macro Economics – Concepts of GDP, GNP, NNP – methods of calculating National Income – problems – difficulties and uses of National Income Analysis. Propensity to consume – multiplier – determinants of consumption.
- Unit 4 : Monetary and Fiscal policy – Government intervention – financial markets – exchange rates – International trade – Balance of payments.
- Unit 5 : Inflation types – interest rate and exchange rate – types of unemployment – public sector finances in an industrial economy.

PRINCIPLES AND PRACTICE OF INSURANCE

Objectives :

To gain practice to apply in Actuarial planning.- To develop control needed for the operation on sound financial lines of Indian life insurance companies.

Pre-requisite : Admission to this Master's programme.

Course outline :

- Unit 1 : Concept of Risk- The concept of Insurance.Classification of Insurance- Types of Life Insurance, Pure and Terms- Types of General Insurance, Insurance Act, Fire, Marine, Motor, Engineering, Aviation and Agricultural - Alternative classification- Insurance of Property, Pecuniary interest, liability and person. Distribution between Life and General Insurance.History of Insurance in general in India. Economic Principles of Insurance – Insurance regulatory and development Act.
- Unit 2 : Legal Principles of Insurance- The Indian Contract Act, 1872- insurable interest - Utmost Good faith-indemnity- subrogation – Contribution- Proximate Cause - Representations- Warranties- Conditions. Theory of rating- Actuarial principles- Mortality Tables- Physical and Moral Hazard. Risk appraisal-Risk Selection- Underwriting. Reinsurance- Concept and Methods.
- Unit 3 : Life insurance organisation : The Indian context. The distribution system, function of appointment and continuance of agency, remuneration to aents, trends in Life insurance distribution channels.Plans of Life Insurance – need levels, term life insurance increasing / decreasing term policy, whole life insurance, endowment insurance, money back endowment plan, marriage endowment plan, education annuity plan, children deferred assurance plans, annuities. Group insurance – nature of group insurance, types of group insurance, gratuity liability, group superannuating scheme, other group schemes, social security schemes. Other special need plan – industrial life insurance, salary saving scheme, disability plans – critical illness plans.

- Unit 4 : Application and acceptance – prospectus – proposal forms and other related documents, age proof, special reports. Policy document – need and format – preamble, operative clauses, proviso, schedule, attestation, conditions and privileges, alteration, duplicate policy.
- Unit 5 : Premium, premium calculation, Days of grace, Non-Forfeiture options, lapse and revival schemes. Assignment nominations loans – surrenders, foreclosures, Married Women’s property Act Policy, calculations. Policy claims, maturity claims, survival benefit payments, death claims, waiver of evidence of title, early claims, claim concession, presumption of death, Accident Benefit and Disability Benefit , settlement options, Valuations and Bonus, distribution of surplus. Types of re-insurance, exchange control regulations, payment of premia, payment of claims etc.

NUMERICAL METHODS

Objectives :

To master numerical techniques used to solve various applied problems.

Pre-requisite : UG Calculus and Algebra

Course outline :

- Unit 1 : Numerical computing and computers – Solving non-linear equations.
 Unit 2 : Solving set of equations.
 Unit 3 : Interpolation and curve fitting.
 Unit 4 : Numerical differentiation and Numerical integration.
 Unit 5 : Numerical solution of ordinary differential equations.

FINANCE AND FINANCIAL REPORTING

Objectives :

The aim of the Finance section of the course is to provide a basic understanding of corporate finance including a knowledge of the instruments used by companies to raise finance and manage financial risk. The aim of the Financial Reporting section of the course is to provide the ability to interpret the accounts and financial statements of companies and financial institutions.

Pre-requisite : Knowledge in financial accounting at UG level

Course outline :

- Unit 1 : Introduction to Finance – Functions of Financial Management – Scope – Organisation – Sources of funds – Long term – Medium term and Short term – Financial risks.
- Unit 2 : Company Management – Types of business entity – pros and cons of limited company – legal documentation – corporate and personal taxation.
- Unit 3 : Capital structure – Net Income approach Net operating Income approach – M M approach Traditional approach – average and personal tax of the investors – concept of cost of capital – factors affecting cost of capital – specific and overall cost of capital.
- Unit 4 : Dividend decision and valuation of the firm – Determinants and constraints of a dividend policy – Financial Institution – IDBI, ICICI, IFCI, UTI, Commercial Banks, Insurance companies etc.
- Unit 5 : Financial reporting – Accounting principles – types – basic financial statement – kinds of reports – Nature of reports – guiding principles of reporting – necessary steps for good reporting.

FINANCIAL ECONOMICS

Objectives :

To develop necessary skills to construct and apply asset liability models and to value financial derivatives.

Pre-requisite : MSI 1043, MSI 1026, MSI 2043, MSI 2044

Course outline :

- Unit 1 : Application of utility theory to financial problems – Stochastic dominance to portfolio selection problems – Advantages and disadvantages of investment risk.
- Unit 2 : Assumptions of mean variance portfolio theory and its principal results – properties of single and multifactor models of asset returns – Liabilities and portfolio selection – asset and liability modelling.

- Unit 3 : Equilibrium models such as capital asset pricing model assumptions and limitations of such models. Forms of efficient market hypothesis – evidence for and against such hypothesis – stochastic models and behaviour of security prices.
- Unit 4 : Estimating parameters for asset pricing models – models of the term structure of interest rates.
- Unit 5 : Hypocrites of option prices – determinants of option prices – upper and lower bounds for option prices – Black Scholes analysis and arbitrage free pricing – numerical procedures used in derivative pricing and valuation.

RESOURCE OPTIMIZATION PRINCIPLES

Objectives :

- To provide various optimization principles in resource allocation and management.
- To train the students to define the problem, construct of the model, find solution of the model, how to validate of the model and how to implement the solution.

Pre-requisite : UG level Calculus.

Course outline :

- Unit 1 : Linear programming problems - model formulation and graphical solution – various types of solutions – simplex method of solving linear programming –duality principles – dual simplex method.
- Unit 2 : Artificial variable techniques Big M method – two phase method – assignment problem – transportation problem – MODI method of finding optimal solutions.
- Unit 3 : Sequencing problem – replacement problems – game theory – zero sum games – graphical method – solution of games by LPP.
- Unit 4 : Decision analysis – components of decision making – decision making without probabilities – maximum – minimax regret – Hurwicz and equal likelihood criterion – decision making with probabilities – expected value – expected opportunity loss criterion.
- Unit 5 : Network flow models – shortest route problem – project management – the CPM and PERT Networks.

MASTER OF COMPUTER APPLICATION (M.C.A.)

Course Code	Title of the Courses	C/E	Credits L-T-P-C	Course Faculty
I SEMESTER				
MSI C301	Digital Principles	C	3-1-0-4	S.Gopinathan
MSI C302	Programming in C & C++	C	3-1-0-4	PL. Chithra/ Guest faculty(G.F.)
MSI C303	Object Oriented Data Structures	C	3-0-0-3	M.Sornam/G.F.
MSI C304	Systems Software	C	3-0-0-3	P.Thangavel/G. F.
MSI C305	C, C++ and Data Structures Lab.	C	0-0-2-2	PL. Chithra/ G.F.
	Elective	E	2-1-0-3	Faculty Concerned
II SEMESTER				
MSI C306	Computer Oriented Statistical Methods	C	3-1-0-4	Guest Faculty
MSI C307	Programming in Java	C	3-0-0-3	PL.Chithra/G. F.
MSI C308	Microprocessors and Applications	C	3-0-1-4	S.Gopinathan
MSI C309	Visual Basic and Web Technology	C	3-0-0-3	M.Sornam/G.F.
MSI C310	Java, Visual Basic and Web Design Lab.	C	0-0-2-2	PL. Chithra & M.Sornam / G.F.
	Elective	E	2-1-0-3	Faculty Concerned
III SEMESTER				
MSI C311	Operating Systems	C	3-0-0-3	PL. Chithra/G.F.
MSI C312	Design and Analysis of Algorithms	C	3-0-0-3	P.Thangavel
MSI C313	Database Management Systems	C	3-0-0-3	M.Sornam
MSI C314	Computer Graphics	C	3-0-0-3	S.Gopinathan
MSI C315	Graphics and RDBMS Lab.	C	0-0-2-2	S.Gopinathan/ M.Sornam
	Elective	E	2-1-0-3	Faculty Concerned
	Elective	E	2-1-0-3	Faculty Concerned
IV SEMESTER				
MSI C316	Computer Networks	C	3-1-0-4	P.Thangavel
MSI C317	Unix and Shell Programming	C	3-0-0-3	PL.Chithra
MSI C318	Software Engineering	C	3-0-0-3	S.Gopinathan
MSI C319	Windows and Network Programming	C	3-0-0-3	Guest Faculty
MSI C320	Unix, Windows and Network Programming Lab.	C	0-0-2-2	Guest Faculty
	Elective	E	3-0-0-3	Faculty Concerned
	Elective	E	3-0-0-3	Faculty Concerned
V SEMESTER				
MSI C321	Mini Project	C	0-0-1-1	All Faculty
MSI C322	Multimedia Systems	C	3-0-1-4	M.Sornam
	Elective	E	3-0-0-3	Faculty Concerned
	Elective	E	3-0-0-3	Faculty Concerned
	Elective	E	3-0-0-3	Faculty Concerned
VI SEMESTER				
MSI C323	Project Work #	C	0-0-15-15	All Faculty
MSI E301	Computer Architecture	E	3-0-0-3	Guest Faculty
ELECTIVES - III SEMESTER				
MSI E302	Principles of Compiler Design	E	3-0-0-3	P.Thangavel
MSI E303	Advanced Java Programming	E	2-0-1-3	Guest Faculty
MSI E304	Programming in COBOL	E	2-0-1-3	Guest Faculty
ELECTIVES – IV SEMESTER				
MSI E306	Artificial Neural Networks	E	3-0-0-3	M.Sornam
MSI E307	Artificial Intelligence &Expert Systems	E	3-0-0-3	Guest Faculty
MSI E308	Distributed Computing	E	3-0-0-3	Guest Faculty
MSI E309	Data Mining and Warehousing	E	3-0-0-3	Guest Faculty

ELECTIVES – V SEMESTER				
MSI E311	Software Project Management & Testing	E	3-0-0-3	Guest Faculty
MSI E312	Software Quality And Assurance	E	3-0-0-3	Guest Faculty
MSI E313	Digital Image Processing	E	3-0-0-3	PL.Chithra
MSI E314	Computer Simulation & Modeling	E	3-0-0-3	Guest Faculty
MSI E315	Computer Aided Design	E	3-0-0-3	S.Gopinathan/ M.Sornam
MSI E316	Pattern Recognition	E	3-0-0-3	Guest Faculty
ELECTIVES – VI SEMESTER				
MSI E317	Web-Commerce	SS	2-2-0-4	Guest Faculty
MSI E318	Object Oriented Analysis and Design	SS	2-2-0-4	Guest Faculty

ELECTIVES – I SEMESTER

Courses Offered for other Departments/Schools

MSI E319	Introduction to Information Technology and Programming in C	E	2-0-1-3	Guest Faculty
ELECTIVES II SEMESTER				
MSI E320	Internet and Java Programming	E	2-0-1-3	Guest Faculty

MSI C301	Digital Principles	C	3-1-0-4	S.Gopinathan
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Number systems - compliments -logic gates-truth tables. Boolean algebra-truth table simplification of boolean function-Map method tabulation method - sequential logic-Flipflops-Registers-shiftreg-counters-processor design -design of an Accumulator Combinational Logic -adders, subtractors, decoders, encoders, multiplexer, demultiplexer. Processor design-arithmetic logic unit - status register - design of accumulator. Computer design - system configuration - computer instructions.

MSI C302	Programming in C & C++	C	3-1-0-4	PL. Chithra/ Guest faculty(G.F.)
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Identifiers, Keywords, Data Types, Access Modifiers, Data Type Conversions, Operators, Conditional Controls - Loop Control – Input/Output Operations, Function Prototypes, Function Arguments - Pointers. Arrays, Accessing Array Elements, Dynamic Memory Allocation, Storage Classes, Structures, Unions, character I/O, String I/O, Formatting Input/Output file, Command Line Arguments. Introduction to OOPS – Overview of C++, Classes, Structures – Union - Friend Functions, Friend Classes – Inline Functions, Constructors – destructors – Static Members – Scope resolution Operator – Passing Objects to Functions, Array, Pointers – Function Overloading, Overloading Constructors. Operator Overloading – Inheritance - Protected Members - Polymorphism – virtual Functions - Exception Handling - I/O Streams – Formations I/O with IOS Class Functions and Manipulators.

MSI C303	Object Oriented Data Structures	C	3-0-0-3	M.Sornam/G.F.
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ADT- asymptotic notations- algorithmic analysis - classes and objects - concepts OOP - Arrays, representation of arrays - linked lists - circular linked lists - Stacks and queues - Binary trees - binary search tree - binary tree traversals--threaded binary tree - binary tree representation of trees - Graphs - spanning trees - shortest paths - sorting and searching - hashing- balanced trees - B-trees – Tries – AVL Tree, SPLAY tree.

MSI C304	Systems Software	C	3-0-0-3	P.Thangavel/G. F.
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Introduction - Assemblers - pass structure- Design of a two pass Assembler. Macros and Macro processors - Design of macro processors. Linkers - design of a linker - linking for program overlays - loaders - Compilers: Aspects of compilation - Programming language grammars - Scanning - Parsing - Storage allocation - Compilation of Expressions and Control structures - Code optimization - Software tools - editors - Debug monitors - Programming environments.

MSI C305	C, C++ and Data Structures Lab.	C	0-0-2-2	PL. Chithra/ G.F.
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Primality test, string manipulation, matrix manipulation, generating permutations and combinations, creating database for telephone numbers and related operations, file processing., etc.- C++ - Implementation of arrays (single and multidimensional), polynomial object and overload operators – circular linked lists – doubly

linked lists – implementation of stacks and queues – circular queues – evaluation of expressions – sorting – AVL trees – insertion etc.

MSI C306	Computer Oriented Statistical Methods	C	3-1-0-4	Guest Faculty
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Sample spaces - events - Axiomatic approach to probability - conditional probability - Independent events - Baye's formula - Random Variables - Continuous and Discrete - distribution function - Expectation, variance, coefficient of variation, moment generation function - Chebyshev's inequality Bivariate distribution - conditional and marginal distributions - Binomial, Poisson and geometric Distributions - Uniform, Normal, Exponential and Gamma distributions. Correlation - Rank correlation - Linear Regression - Method of Least squares - Fitting of the curve of the form $ax + b$, $ax^2 + bx + c$, abx and axb - multiple and partial correlation(3 - variables only). sampling - simple random sampling - Systematic sampling and stratified random sampling - concepts of sampling distributions and standard error - point estimation - Interval Estimation of mean and proportion. Tests of Hypotheses - Critical Region - Errors - Level of significance - power of the test - Large sample tests for mean and proportion - Exact tests based on Normal, t, F and Chi-square distributions. Basic principles of experimentation - Analysis of variance - one way and two way classifications - computing randomized design - Randomized Block design - Time series Analysis - Measurement of Trend and Seasonal variations.

MSI C307	Programming in Java	C	3-0-0-3	PL.Chithra/G. F.
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Prerequisite : MSI C302

Differences with C++ - interfaces - packages - applications - Applet - threading - synchronization - errors and exception - graphics - input/output files - streams - applet life cycle - thread life cycle.

MSI C308	Microprocessors and Applications	C	3-0-1-4	S.Gopinathan
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Prerequisite : MSI C301

Introduction to 8085/8086 Microprocessor Architecture and Pin Function. Introduction to 8086 Instruction Set – Data Transfer – Arithmetic – Logic – Shift – Compare – Jump – Loop – Flag – Stack – Subroutine Instructions – 8086 Instruction formats – Assembly Language - Programs with Examples. Interfacing Data Converter – Digital-to-Analog , Analog-to- Digital - Memory Interface - Address Space - Programmable Peripheral Interface (8255A) – 8279 Programmable Keyboard Interface – 8086 Interrupts – Direct Memory Access – Burst Mode and Cycle Stealing. Temperature Control Monitoring Systems – Traffic Light Control Interface – Stepper Motor Interface – Interfacing 7 Segment LED Display – Introduction to Operational Amplifier.

MSI C309	Visual Basic and Web Technology	C	3-0-0-3	M.Sornam/G.F.
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Visual Basic: Features - VB Application - Control/properties/methods - Dialog boxes - VB Language - procedures and functions - in built function - object variables- API function. Internet concepts, Type of Accounts, ISP-TCP/IP and Connection software, Designing Interactive Webpages, HTML, DHTML, Basic Scripting-Java script, VB script, XML,ASP, ASP.NET,VB.NET.

MSI C310	Java, Visual Basic and Web Design Lab.	C	0-0-2-2	PL. Chithra & M.Sornam / G.F.
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Sub-string removal from a string using string buffer class – determining the order of numbers generated randomly using random class – usage of data classes – string manipulation using char array – usage of vector class – thread based applications – Applets- working with frames and various controls – working with dialogs and menus – panels and layouts – incorporating graphics – working with colors and fonts, etc. Visual programming – building simple applications – working with intrinsic controls and ActiveX controls – applications with multiple forms, dialogs, menus – application using data controls, common dialogs – drag and drop events – database managements – creating ActiveX controls, etc. Web Technology – greeting with pictures – downloading text and images – design a web page of your teacher, about your personal details, for a latest product, for any educational institution, for railway reservation, for social awareness, for environmental awareness and design web page for a hospital, etc.

MSI C311	Operating Systems	C	3-0-0-3	PL. Chithra/G.F.
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Prerequisite : MSI C301 or MSI C302

Multiprogramming - Time sharing - Distributed system - Real - Time systems - I/O structure - storage hierarchy - Hardware protection - General system architecture - Operating system services - System calls - System

programs - System design and implementation. Processes - CPU scheduling - process synchronization - Deadlocks - Storage management - memory management - virtual memory - Secondary storage management - file system interface, implementation - secondary storage structure - protection - security - UNIX system.

MSI C312	Design and Analysis of Algorithms	C	3-0-0-3	P.Thanagvel
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Prerequisite : MSI C303

Introduction - asymptotic time analysis. Divide and conquer Method: binary search, finding maximum and minimum, merge sort and quick sort. Greedy method: optimal storage on tapes, knapsack problem, minimum spanning trees and single source shortest path problem. Dynamic programming: multistage graphs, 0/1 knapsack and traveling salesman problem. Basic search and traversal techniques: And/Or graph, bi-connected components, depth first search. Backtracking: 8 queens problem, sum of subsets, graph coloring, Hamiltonian cycle and knapsack problem. Branch and bound: 0/1 knapsack problem, traveling salesman problem.

MSI C313	Database Management Systems	C	3-0-0-3	M.Sornam
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Prerequisite : MSI C302 & MSI C303

Purpose of Database Systems - relational, hierarchical and network models - SQL - PL/SQL - Client Server Concepts - relational calculus - relational algebra - QBE - normalization - virtual records - DBTG model - query processing and interpretation - query optimizer - database recovery - security and integrity.

MSI C314	Computer Graphics	C	3-0-0-3	S.Gopinathan
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Prerequisite : MSI C303 / MSI C309

Line Generation : Circle Generation - Graphics Primitives - Display devices - Display file co-ordinates - Polygons : Polygon Filling - Scaling, Rotation & Translation Transformations - Display procedures - Segments - Segment manipulation - Raster Techniques - Windowing and Clipping - Device handling algorithms - Simulating devices - Echoing - Interactive Techniques - 3D Fundamentals - Projections - Clipping in 3D- 3D viewing transformation - Hidden surfaces and lines. Dimension - Binary space partition- Light, color and shading - Transparency - Shadows - Ray tracing - Halftones - Color - Gamma correction - Fractals - Splines.

MSI C315	Graphics and RDBMS Lab.	C	0-0-2-2	S.Gopinathan/ M.Sornam
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Generate line, circle and box etc., using graphics primitives – generate line, zigzag line using DDA algorithm – generate line, circle, ellipse using Bresenham’s algorithm - generate character using bit-map method and DDA line drawing method – 2D transformation for scaling, translation, rotation, reflection, shearing – 3D transformation for scaling, translation, rotation – line clipping, character clipping and polygon clipping – generate any type of 3D object etc. RDBMS – creation of database and performing the operation given below using menu driven programming - insert, delete, modification, and report preparation – payroll – mark sheet processing – savings bank account for banking – inventory – invoice – library information system – railway reservation – income tax processing system – election ballot system – telephone directory maintenance – etc.

MSI C316	Computer Networks	C	3-1-0-4	P.Thangavel
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Prerequisite : MSI C311

Goals and Applications of networks - Network Architectures - OSI reference model and services - Network topology - Physical layer - Transmission media - switching methods- Data link layer Design issues - error detection and correction - elementary data link protocols - sliding window protocols-Protocol specification & verification. Network layer-design issues-Routing, congestion, inter networking, - Routing algorithms - Shortest path, Multipath, Centralized, Isolated, Flooding, Distributed, Optimal, flow Based, Hierarchical & Broadcasting - Congestion control algorithms - pre allocation of buffer, packet discarding, flow control, choke packets, deadlocks. Transport layer - design issues - Connection management - Addressing, Establishing & Releasing a connection, Timer based Connection Management, Multiplexing, Crash Recovery, Email, - Cryptography - case studies: Arcnet, Ethernet, Arpanet.

MSI C317	Unix and Shell Programming	C	3-0-0-3	PL.Chithra
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File and Common Commands - Shell – Directories – Devices – Permission – The Grep Family Filters – Streams – Concepts of Shell – Trapping Exit Codes- Shell Programming – Standard Input/Output – file Access –

System Calls-Interprocess Communication-DeadLock Detection-Scheduling algorithms- Inodes – Processes – Signals- Interrupts – Preprocessors – Manual Page.

MSI C318	Software Engineering	C	3-0-0-3	S.Gopinathan
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Prerequisite : MSI C302

Software and Software Engineering - Software Metrics - Estimation - Planning. Software Requirement Analysis: Computer systems Engineering - Fundamentals of Requirement Concepts of Structured Analysis - SADT; Object Oriented Analysis and Data Modeling - Alternate analysis techniques - Specification techniques. Software Design and Implementation : Programming Languages and Coding. Software Testing Techniques and Strategies. Software Quality Assurance. Software Maintenance - Software Configuration Management. Computer Aided Software Engineering Integrated CASE Environments (I-CASE).

MSI C319	Windows and Network Programming	C	3-0-0-3	Guest Faculty
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Prerequisite : MSI C307

Windows Fundamentals – Programming Concepts and Vocabulary For Windows – Windows Development tools – Resource Information, Application Frame Work, Project Utility – MFC Library – Bar Chart with Resources. Graph Applications – Word Processor Applications – OLE Features and Specifications Continual Application, ActiveX Controls, Com – DHTML – ATL Vs ACTIVEX-Overview of ActiveX Scripting-Java Scripting – Standalone scripts-ActiveX Controls- Creating ActiveX Controls- ActiveX Documents- ActiveX Document Architecture-URL Monikers- Hyper linking interface- Working with URL Monikers- Overview of ISAPI- ISAPI Extension-ISAPI Filter-Designing IIS Application-Building IIS Application-Building Data Driven DHTML Application- ActiveX documents-Technology Migration Wizard-Modified Code-Launching and Testing document-Testing the DLL.

MSI C320	Unix, Windows and Network Programming Lab.	C	0-0-2-2	Guest Faculty
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Shell script to solve quadratic equation – menu driven – user friendly changing modes – simple script for all control structures – process scheduling – authorized access – using pipes to calculate NCR – inter process communication using message queues – IPU using pipes – implementation of wait and signal using counting semaphores - automatic counter update problem – signaling process – deadlock detection - producer, consumer problems. Windows programming – SDK program for window creation and display – window creation using CFrameWnd – usage of mouse routines – creating menus – implementing keyboard accelerators – checking / unchecking and enabling / disabling menus – inserting and removing menus at runtime – floating popup menus – MDI with cascaded and tiled window – creating modal and modeless dialog box - creating status bar – using list box with Clist Box class - using edit box with Cedit Box class – working of spin button controls – creating graphics editor etc. Network programming – working with java scripts – creating ActiveX controls – OLE server – OLE container – working with URL monikers – creating an ISAPI extension - creating an ISAPI editor – building IIS application – data driven DHTML application – ActiveX documents.

MSI C321	Mini Project	C	0-0-1-1	All Faculty
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Each student will take a specific problem for the Mini Project and solve it Using any one of latest tool and submit the report.

MSI C322	Multimedia Systems	C	3-0-1-4	M.Sornam
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Prerequisite : MSI C314

Evaluation of Multimedia - Components of Multimedia system - Hardware - Multimedia PC-Memory and Storage devices for multimedia - ODD and CD Technology and standards - Input devices - Output devices - Communication devices and peripheral connections. Software components of multimedia - text, audio, image and video processing - Elementary and Authoring tools - Interactive video and 3D Graphics in Multimedia. Multimedia Information Systems - Extending RDBMS to Image Management Systems, and voice Information Systems - MPEG, JPEG, DVI and UVC standards applied to multimedia and Distributed Information Systems. Organizing, Design, production and Testing of Multimedia projects. Case studies in Education - Industrial Design - Presentation of software and concepts of virtual reality – video compression, audio compression, video conferencing and mobile multimedia.

MSI C323	Project Work #	C	0-0-15-15	All Faculty
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Each student will do a project work and submit report of their work carried.

MSI E301	Computer Architecture	E	3-0-0-3	Guest Faculty
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Prerequisite : MSI C301

Data representation - micro operations - Register transfer - micro programmed control - Central processing unit - Pipe lining - Vector processing and Array processors. Computer Arithmetic. Input-output organization - Memory organization - multi processors

MSI E302	Principles of Compiler Design	E	3-0-0-3	P.Thangavel
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Prerequisite : MSI C309

Introduction - Finite Automata and lexical Analysis. Syntax Analysis - Context free grammars - Derivations and parse trees - Basic parsing techniques - LR parsing - Syntax - directed translation - symbol tables. Code optimization, generation - Error detection and recovery.

MSI E303	Advanced Java Programming	E	2-0-1-3	Guest Faculty
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Servlet Overview, Java Webserver, Servlet Chaining, Session Management, Using JDBC in Servlets, Applet to Servlet Communication, Java Beans EJB Architecture, Design and Implementation, EJB Session Beans, EJB Entity Beans, Implementation and Entity Direction of EJB, JSP,J2EE

MSI E304	Programming in COBOL	E	2-0-1-3	Guest Faculty
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Introduction to COBOL-IDENTIFICATION Division-PROCEDURE Division-Debugging and program testing- Keyboard Input and screen Display-Output formatting -Arithmetic Operations-Report design and coding-Conditional Operations-Designing and writing Control Break programs-Data Validation design and coding-processing Arrays/Tables-Processing multidimensional Tables-Sorting-Master-Transaction File Processing-Indexed File Processing-Program Management.

MSI E306	Artificial Neural Networks	E	3-0-0-3	M.Sornam
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Prerequisite : MSI C306

Basics of ANN - Characterization of biological neural networks - Artificial intelligence Vs Neural networks - Principles and Promises - Learning rules. Functional Units - Activation functions - Feed forward ANN - single layer network Limitation - Need for Multi-layer network - Capabilities - Back propagation algorithm - applications - limitations. Feedback ANN - Hopfield network - Architecture - Dynamics - energy function - Applications - optimization - Traveling Salesman Problem - A/D converter. Feedback and feed forward networks - Competitive learning algorithm - weight initialization issues solving convex combination method - Noise addition and Neighborhood method - feature mapping - self organizing map - Applications. Neural architectures for complex pattern recognition tasks - counter propagation network - applications - image compression - function approximation look up table - Bi-directional Associative Memory - Variations on BAM - Applications.

MSI E307	Artificial Intelligence & Expert Systems	E	3-0-0-3	Guest Faculty
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Prerequisite : MSI C303

Evolution of Artificial Intelligence production systems - search strategies - Hill climbing, backtracking graph search - algorithm A and A *, monotone restriction specialized production systems - AO* algorithm. Searching game trees: Minimax Procedure alpha beta pruning - predicate calculus - Answer extraction - knowledge based systems - knowledge processing, inference techniques. Expert system Definition - stages in development - knowledge representation and acquisition techniques - building expert systems - Forward and Backward Chaining - Tools - Explanation facilities - Meta Knowledge - fuzzy reasoning - case study: Mycin. Applications of A.I - Natural language processing and understanding - perception - Learning using Neural nets.

MSI E308	Distributed Computing	E	3-0-0-3	Guest Faculty
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Prerequisite : MSI C311

Models for Distributed Computing - Remote procedure calls - Switched multiprocessor - Bus based multi-computer - Switched multi-computers - Network operating systems and NFS - Time distributed systems - Transparency - Flexibility - Reliability - performance - scalability - The client - server model - Blocking and unbuffered primitives - Implementation of client-server model. Synchronization in distributed systems - Clock synchronization - Mutual exclusion - Election algorithms - Atomic transactions - Dead locks in distributed system

- Threads - Thread usage and implementation of thread packages - processor allocation - Distributed File System - Implementation of new trends in distributed file systems - Distributed databases.

MSI E309	Data Mining and Warehousing	E	3-0-0-3	Guest Faculty
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Main operations: Clustering, Classification, Regression, Neural Networks, Feature Selection, Deviation, Detection – Context of Data mining – Four approaches to Data mining – Data mining Methodology – Three pillars of Data mining – Data for Data mining – Dirty Data – Settling Data mining Environment – Data Warehouse Database – Analyzing context of Data Warehouse, Basic Data Warehouse Architecture, Online Analytical Processing Systems (OLAP). Success and failure stories of Data mining - Survey of existing mining & OLAP Products. Applications in Web mining.

MSI E311	Software Project Management & Testing	E	3-0-0-3	Guest Faculty
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Introduction to Software Project Management- Software project versus other types of project- problems-management control- Stakeholders- Requirement Specification – Information and control in organizations Introduction to step wise project planning- Select-identify scope and objectives- waterfall model- v-process model- spiral model- software prototyping- ways of categorizing prototypes- tools- incremental delivery- selecting process model -Software effort estimation- introduction- where-problems with over and under estimates- basis for software estimating- software effort estimation technique- expert judgment-COCOMO -Activity Planning- Objectives-Project schedules- projects and activities- sequencing and scheduling activities- sequencing and scheduling problem-job sequencing-n jobs through two machines, two jobs through m-machines and n-jobs through m-machines, PERT and CPM techniques-critical path-Normal path and crash time-Resource allocation-Resource leveling and smoothing.

MSI E312	Software Quality And Assurance	E	3-0-0-3	Guest Faculty
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Introduction - Quality and the quality system - standards and procedures technical activities. Software tasks - management responsibility - quality system - contract review - design control - document control - purchasing - product identification and traceability. Process control - checking - identification of testing tools - control of nonconforming product - Corrective action. Handling, storage, packing and delivery - Quality records - Internal quality audits - Training - Servicing - statistical techniques. QA and new technologies - QA and Human - Computer interface - process modeling - standards and procedures. ISO-9001 - Elements of ISO 9001 - Improving quality system - Case study.

MSI E313	Digital Image Processing	E	3-0-0-3	PL.Chithra
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Prerequisite : MSI C314

Introduction - Problems and Applications - Two dimensional systems and Mathematical preliminaries - Linear Systems and Shift invariance - Fourier Transform - Properties - Fourier Series - Matrix theory results - Block Matrices and kronecker products. Image perception - light, luminance, Brightness and Contrast - MTF of Visual systems - Monochrome vision models - image fidelity criteria - color representation. Digital image sampling and quantization - 2D sampling theory - image reconstruction from samples, Bandlimited images, sampling theorem, Nyquist rate, Aliasing and foldover frequencies - image quantization - Optimum mean square Quantizer. Image Enhancement - point operations - contrast structuring, clipping & thresholding etc - Histogram modeling - spiral operations - special averaging & low pass filtering, Directional Smoothing, median filtering, Replication, Linear interpolation, Magnification & interpolation (Zooming) - false color and pseudo color. Image restoration - Image observation models - Inverse and Wiener filtering - Least square filters - Image Analysis - Edge Detection - Boundary extraction - Boundary representation - Region representation - Image Segmentation - Classification Techniques - Image understandings. Image Data Compression - Pixel coding - PCM, Entropy coding, Runlength, Bitplane extraction - Predictive techniques - Delta Modulation line by line DCPM etc - Interface - Coding of two tone images.

MSI E314	Computer Simulation & Modeling	E	3-0-0-3	Guest Faculty
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Prerequisite : MSI C306

Introduction to Simulation: types of system - Discrete and Continuous Systems - Model of a System - Types of Models - Discrete-Event System Simulation - Steps in a Simulation Study; Simulation Examples. Discrete and continuous simulation Languages -study and use of one language in detail. Simulation of Manufacturing and Material Handling Systems - Simulation of Queuing Systems - Random-Number Generation-Tests for Random Numbers. Random Variate Generation: Inverse Transformation Technique:- Uniform Distribution - Exponential Distribution - Weibull Distribution - Triangular Distribution - Empirical Continuous Distribution - Discrete Distribution - Direct Transformation for the Normal Distribution - Convolution Method for Erlang Distribution - Acceptance - Rejection Technique: Poisson Distribution - Gamma Distribution. Input Data

Analysis: Data Collection - Identifying the Distribution with Data - Parameter Estimation - Goodness-of- Fit Tests:- Chi-Square Test - Kolmogorov-Smirnov Test; Selecting Input Models without Data - Multivariate and Time-Series Input Models. Verification and Validation of Simulation Models - Calibration and Validation of Models - Output Data Analysis - Alternative System Designs

MSI E315	Computer Aided Design	E	3-0-0-3	S.Gopinathan/ M.Sornam
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Prerequisite : MSI C314

Introduction to CAD; Role of Computers in the design process. Hardware - Input devices, Display devices, Output devices, Computation devices. Computer Graphics Software and Data Base - Software configuration of a Graphics System - Data Base Structure and content - Wire Frame Modeling, Surface Modeling, Solid Modeling. Numerical Control, The beginning of CAM : Conventional Numerical Control - Components of an NC system - NC procedure - Coordinate systems - Applications. NC Part Programming - Manual Part Programming. NC Programming with Interactive Graphics. Computer Controls in NC - Computer and Direct Numerical Control - Adaptive Control Machining system. Applications: CAD for LSI/VLSI applications: Device circuit and process modeling for IC technology: optimization techniques in IC design: Design automation, Design for testability: Specific examples. Mechanical Drafting: Basic CAD Two-dimensional drafting, mechanical CAD software, developing a mechanical database, solid modeling. Electrical applications: Advantages of computer graphics systems for electrical design and drafting, CAD as an aid to electrical designers and drafters, production of an electrical schematic or wiring diagram, production of a printed-circuited board design, designing integrated circuits. Piping and Instrumentation diagrams: Setting up the system, applying P and ID, creating the drawing, drawing revisions, text drawing annotation, text revisions, drawing formats, report generation, documentation: Plotters. Solid Modeling: Converging technologies of CAD, CAM and CAE, interacting with SM systems, display requirements. Cartography: Mapping applications - uses and users, map production, automated cartography. Case Studies: LPKF, Unigraphics CAD/CAM Software, NISA Finite Element Analysis Software, GOS CAD Package.

MSI E316	Pattern Recognition	E	3-0-0-3	Guest Faculty
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Prerequisite : MSI C306

Basic concepts, Fundamental Problems, Design concepts and examples. Decision Function: Role of decision functions in Pattern recognition, Linear and Generalised decision functions, concepts of pattern space and weight space. Geometrical properties. Implementation of decision functions, Multivariable functions. Pattern Classification : Pattern Classification by distance functions, Likelihood function - Minimum distance classification. Clusters and cluster seeking algorithms. Introduction to the problem of feature selection and extraction. Binary feature selection, Statistical and Structural Feature Extraction. Introduction to Tree languages and Syntactic Pattern Recognition. Syntactic Pattern Recognition on the Basis of Functional approximation Syntactic pattern description, recognition grammars. Acquisition and Utilisation of Access Patterns in Relational Data Base Implementation, Knowledge Acquisition Algorithms.

MSI E317	Web-Commerce	SS	2-2-0-4	Guest Faculty
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Prerequisite : MSI C309

Environment - Opportunities - Modes - Security - E-Cash - E-Payment - E-Transaction - E-Mail Technologies for E-Commerce - Web Site Establishment - Internet Resources - Advertising - Publishing issues - Approaches - Legalities - Technologies.

MSI E318	Object Oriented Analysis and Design	SS	2-2-0-4	Guest Faculty
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Prerequisite : MSI C302 & MSI C307

Systems Development - Object Basics - Development Life Cycle - Methodologies - UML - Use-Case Models - Object Analysis - Object Relations - Design Processes - Design Axioms - Class Design - Object Storage - Object Interoperability - View Layer - Software Quality Assurance - System Usability - Measuring User Satisfaction - Case Studies.

Elective Courses offered for other Departments/Schools

MSI E319	Introduction to Information Technology and Programming in C	E	2-0-1-3	Guest Faculty
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Introduction to Computer – Classification of Digital Computer System – Computer Architecture – Number System – Memory Unit – Input–Output Device – Logic Gates – Truth Table. Introduction to Computer Software - Programming Language C– Identifiers – Keywords – Data Types – Access Modifiers – Data Type

Conversions – Operators – Conditional Controls – Loop Control – Input/Output Operations – Function Prototypes – Function Arguments – Arrays – Structures-Implementing some Problems Using 'C' Language. Introduction to MS-WORD, MS-ACCESS, MS-EXCEL – Creating Recruitment Database and Create Application Table - Creating Tables Using EXCEL - Creating Graphs – MS-ACCESS – Planning and Creating Tables and Using the feature of Chart, Bar Chart, Pie Chart etc. Introduction to Internet – Creating an E-Mail Account using E-mail Service.

MSI E320	Internet and Java Programming	E	2-0-1-3	Guest Faculty
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Internet Concepts – Internet Services – Types of Accounts – Media for Internet – ISP – TCP/IP and connection software – Dial-Up Networking - Setting up and Internet Connections. Introduction to Java – Features of Java – Object Oriented Concepts – Lexical Issues – Data Types – Variables – Arrays – Operators – Control Statements, Packages – Access Protection – Importing Packages – Interfaces – Exception Handling – Throw and Throws – Threads – Applets – Java Utilities – Code Documentation.

M.Phil. MATHEMATICS

Course Code	Title of the Course	Core	Credits				Faculty
			L	T	P	C	
MSI C001	Algebra	C	4	1	0	5	V.R. Chandran
MSI C002	Analysis	C	4	1	0	5	Agrawal Sushama
MSI C003	Topology and Geometry	C	4	1	0	5	K.Parthasarathy
MSI C004	Dissertation and Viva-voce	C				21	All Faculty Members

M.Phil.COMPUTER SCIENCE

Course Code	Title of the Courses	C/E	L-T-P-C	Faculty
First Semester				
MSI C101	Research Methodology	C	3-2-0-5	Guest Faculty
MSI C102	Advance course on Computing	C	3-2-0-5	P.Thangavel
MSI E101	Elective	E	3-2-0-5	P.Thangavel/G.F.
Second Semester				
MSI C103	Dissertation and Viva-voce	C	6+15=21	P.Thangavel/G.F

P.G.DIPLOMA IN COMPUTATIONAL MATHEMATICS AND STATISTICS

Paper	Title of the Course	L	T	P	C
I SEMESTER					
MSI C076	Discrete Mathematics	3	1	-	4
MSI C077	Mathematics of Finance and Insurance	4	1	-	5
II SEMESTER					
MSI C078	Computational Mathematics	3	1	1	5
MSI C079	Introduction to Information Technology + Computational Laboratory-I	2	1	1	4
III SEMESTER					
MSI C080	Computational Statistics	3	1	1	5
MSI C081	Computer Programming in C and C++ +Computational Laboratory-II	2	1	1	4
IV SEMESTER					
MSI C082	Game Theory and Strategy	4	1	-	5
MSI C083	Internet and Java Programming + Computational Laboratory-II	2	1	1	4

MSI C076	Discrete Mathematics	3	1	-	4
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Objectives:

- To develop mathematical maturity and ability to deal with abstraction.
- To develop problem-solving skills in different aspects of application mathematics.

Course Content:

- Unit-I : Logic and the Language of Mathematics
Propositions – Conditional propositions and Logical Equivalence – Quantifiers – Proofs – Mathematical Induction- Sets Sequences and Strings – Number Systems – Relations – Equivalence Relations – Matrices of Relations – Functions.
- Unit –II : Counting Methods and the Recurrence Relations: Basic Principles – Permutations and Combinations – Generalized Permutations and Combinations – Binomial Coefficients and Combinatorial Identities – The Pigeonhole Principle- Solving recurrence relations – Simple problems and applications.
- Unit-III: Graph Theory : Paths and Cycles – Hamiltonian Cycles and the Traveling Salesman Problem – Representations of Graphs – Trees – Spanning trees – Minimal spanning trees – Binary trees - Tree traversals.
- Unit-IV : Network models, Boolean algebras and Combinatorial circuits :
Algorithms – A Maximal Flow Algorithm – The Max flow, Min Cut Theorem – Matching – Combinatorial Circuits and their Properties – Boolean algebras – Boolean functions - Synthesis of circuits - Applications.
- Unit- V : Automata, Grammars and Languages
Sequential Circuits and Finite State Machines – Finite State Automata – Languages and Grammars – Non-deterministic Finite State Automata – Relationships between Languages and Automata

MSI C077	Mathematics of Finance and Insurance	4	1	-	5
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Objectives:

To provide fundamentals in financial transactions, discounting, repayments, term structure, derivatives and stochastic interest rate models.

To gain practice to apply in Actuarial planning.

Course Content :

- Unit-I : Theory of Interest – The basic compound interest functions- Nominal rates of interest: annuities payable p-thly – Discounted cash flow
- Unit-II : Capital redemption policies- The valuation of securities – Capital gains tax – cumulative sinking funds
- Unit-III : Yield curves, discounted mean terms, matching and immunization
Consumer credit and Stochastic interest rates models
- Unit-IV : Mortality table – Annuities, Assurances, Premiums- Functions other than yearly.
- Unit-V : Policy values – surrender and paid-up values: Bonus: Special policies- Applications of calculus :
Population Theory

MSI C078	Computational Mathematics	3	1	1	5
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Objectives :

To develop computational problem-solving skills, ideas- To apply mathematical concepts to other science and social science subjects

Course Content :

- Unit-I : Graphs and Functions : Cartesian Coordinate Systems and Straight Lines – Linear and Quadratic Functions – Aids to Graphing Functions- Exponential and Logarithmic Functions- Analytical Geometry and the Conic Sections – Polar Coordinates – Area Computations in Polar Coordinates – Parametric Curves – Applications
- Unit-II : Systems of Linear Equations : Systems of Linear Equations in Two Variables – Systems of Linear Equations and Augmented Matrices – Gauss-Jordan Elimination – Matrices-Addition and Multiplication by a Number – Matrix Multiplication – Inverse of a Square Matrix – Matrix Equations and Systems of Linear Equations – Leontief Input-Output Analysis.
- Unit-III : Differential Calculus : Limits and Continuity-A Geometric Introduction – Computation of Limits – The Derivative – Derivatives of Constants, Power Forms and Sums – Derivative of Products and Quotients – Chain Rule : Power Form – Marginal Analysis in Business and Economics.
- Unit-IV : Integral Calculus : Antiderivatives and Indefinite Integrals – Integration by Substitution – Differential Equations-Growth and Decay – Area under a curve – Definite Integrals – The Fundamental Theorem of Calculus – Applications in Business and Economics.

Unit-V : MAPLE Programming : Introduction to mathematical computer programming in MAPLE, as tools for the solution of mathematical problems and for mathematical experimentation. Programming topics will include data types, expressions, statements, control structures, procedures and recursion. Examples and practical work will include computing with integers, polynomials, matrices, data files and numerical approximations.

Computational Laboratory Exercises : MAPLE Exercises: Plotting Curves Composition of functions, inverses Sequences and series (finite and infinite sum) Slope of a line, a secant, a tangent Equations of tangents Limit and continuity 2-D and 3-D graphs Symbolic Differentiation and Symbolic Integration Conversion of coordinates, Areas in Polar coordinates Symbolic manipulation on matrices Solution to equations Solution to Differential equations

MSI C079	Introduction to Information Technology + Computational Laboratory-I	2	1	1	4
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Objectives:
To provide basic understanding of information technology

Course Content:

Unit-I : Introduction to Computer – Classification of Digital Computer System – Computer Architecture – Number System – Memory Unit – Input–Output Device
 Unit-II : Logic Gates – Truth Table. Introduction to Computer Software - Programming Languages
 Unit-III : Introduction to MS-WORD – Creating documents, Tables, Importing charts, Mail merge - Preparing bio-data- Copying Text and Pictures from Excel
 Unit-IV : MS-ACCESS Creating Recruitment Database and Create Application Table which has Applicant Name, Name, Address, Phone Number, E-mail etc – MS-ACCESS – Planning and Creating Tables and Using the feature of Chart, Bar Chart, Pie
 Unit- V : MS-EXCEL - Creating Tables Using EXCEL – Using Tables and Creating Graphs , Usage of formulae and Built-in Functions-File Manipulations

POWER POINT-Inserting Clip Arts and Pictures-Insertion of new slides-Presentation using Wizards-Usage of design Templates.

Computer Laboratory Exercises :
 MS-WORD- To create Bio-Data-To create Bar chart- To create Mail Merge-MS-EXCEL
 1. Student Mark List
 Bar Chart creation with Employee details-Pie- Chart – Company’s Growth from 1990-2000- MS-POWER POIN-
 Birth day Greetings- Marriage Invitation- Demo in your specialization-MS-ACCESS-Employee Database
 Creation-Librarys Information Management-Hospital Management System

MSI C080	Computational Statistics	3	1	1	5
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Objectives:
To provide a thorough grounding in classical-methods of statistical inference with an introduction to more new developments in statistical methodology.- To provide students with the necessary technical skills and practical experience to enable them critically to evaluate research results and to carry out high quality empirical work for themselves.- Emphasis throughout the course is on the application of statistical techniques rather than the development of theory.

Course Content:

Unit- I : Data and Statistics : Data – Data Sources - Descriptive Statistics: Tabular and Graphical Methods:- Summarizing the Qualitative Data and Quantitative Data – Exploratory Data Analysis (Stem and Leaf Display) – Cross tabulations and scatter diagrams
 Descriptive Statistics: Numer ical methods :- Measures of location – measures of variability – Measures of relative location and detecting outliers – Exploratory Data Analysis – Measures of association between two variables – the weighted mean and working with grouped Data
 Unit-II : Introduction to Probability – discrete probability distributions and Continuous distribution
 functions:
 Experiments – events – assigning probabilities – basic relationships of probability – conditional probability – Bayes theorem – Moments-

Unit-III: binomial, Poisson and hyper-geometric distributions – uniform(continuous), normal. Exponential distributions.
: Sampling and Sampling Distributions Sampling methods – Sampling distributions of sample

mean and sample proportion – Point estimation and properties.-Tests of Goodness of Fit and Independence – Multinomial population, Poisson and Normal distributions – Test of independence.

Unit-IV : Analysis of Variance and Experimental Design: - Testing of the equality of k population means- – Completely randomized Design – Randomized Block design – Multiple comparison procedures – Factorial Experiments (2²)

Unit-V : Simple linear and multiple Regressions : - The regression model – Least squares model – coefficient determination – Model assumptions – Testing of significance – using the estimated regression equation and prediction – Residual analysis - qualitative Independent variables in the case of multiple regression(binary response).

Computational Laboratory Exercises :
EXCEL Exercises :

Tabular and Graphical Methods -Descriptive Statistics (mean, median, mode, variance and Standard deviation) - Discrete Probability Distributions (computing binomial and Poisson probabilities)- Continuous Probability distributions (Normal distribution)- Random Sampling -Interval Estimation of a Population mean (Large-Sample and Small-Sample cases) -Hypothesis Testing for mean (Large-Sample and Small-Sample cases) -Hypothesis Testing about the difference between two population means(Large-Sample, Small-Sample and Matched Sample) - Population variances (One population and two populations) -Tests of Goodness of fit and Independence -Analysis of Variance and Experimental Design (Single-Factor Observational Studies and Completely randomized designs – Factorial Experiments(2²))- Simple Linear Regression Analysis-Correlation Analysis

MSI C081	Computer Programming in C and C++ +Computational Laboratory-II	2	1	1	4
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Objectives:

To develop skill in writing codes in C and C++ programming languages

Course Content:

Unit-I : Identifiers – Keywords – Data Types – Access Modifiers – Data Type Conversions – Operators
Unit-II : Conditional Controls – Loop Control – Input/Output Operations – Function Prototypes – Function Arguments – Arrays – Structures – Unions – Pointers.
Unit-III : Introduction to OOPS – Overview of C++ - Classes – Structures
Unit-IV : Friend Functions – Constructors – Destructors – Arrays
Unit-V : Function Overloading, Operator Overloading – Inheritance – Polymorphism.

Computer Laboratory Exercises:

Programming Problems in C:

Factorial of a number -Fahrenheit to Celcius- To count the no. of vowels and consonants in given string-Matrix manipulation-Palindrome checking- Fibonacci series

Programming Problems in C++:

To calculate simple interest and compound interest using class and objects- Initialising and destructing the character array using constructor and destructor functions-Adding 2 complex numbers using operator overloading-To calculate volume of sphere , cuband rectangle using function overloading-Calculate the area of triangle and rectangle using single inheritance-To maintain student’s details using multiple inheritance

MSI C082	Game Theory and Strategy	4	1	-	5
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Objectives:

To provide mathematical game theory in an interdisciplinary context

Course Content:

Unit-I : Two-person zero-sum games : The nature of game – matrix games: dominance and saddle points – matrix games: mixed strategies- Application to Anthropology: Jamaican Fishing- Application to Warfare: Guerrillas, Police, and Missiles - Application to Philosophy :

Unit-II : Two-person non-zero-sum games :	Newcomb's Problem and Free Will – Game trees- Application to Business: Competitive Decision making – Utility theory – Games against nature. Nash Equilibria and non-co-operative solutions – The Prisoner's Dilemma – Applications to Social Psychology: Trust, Suspicion, and the F-Scale – Strategic Moves – Application to Biology : Evolutionarily Stable Strategies – The Nash Arbitration Scheme and Co-operative solutions- Application to Business: Management Labour Arbitration – Application to Economics: The duopoly Problem.
Unit-III : N-Person Games :	An introduction to N-person games – Application to Politics: Strategic Voting – N-person Prisoner's Dilemma – Application to Athletics: Prisoner's dilemma and the Football Draft – Imputations, Domination and Stable sets – Application to Anthropology: Pathan Organization.
Unit-IV : N-Person Games :	The Core – The Shapley Value – Application to Politics: The Shapley-Shubik Power Index – Application to Politics: The Banzhaf Index and the Canadian Constitution
Unit-V : N-Person Game :	Bargaining sets – Application to Politics: Parliamentary Coalitions – The Nucleolus and the Gately Point – Application to Economics: Cost Allocation in India.

MSI C083	Internet and Java Programming + Computational Laboratory-II	2	1	1	4
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Objectives:

To have hands-on experience on internet and to develop skills in writing codes for internet.

Course Content :

Unit-I :	Internet Concepts – Internet Services – Types of Accounts – Media for Internet – ISP – TCP/IP and connection software – Dial-Up Networking - Setting up and Internet Connections.
Unit-II :	Introduction to Web – Using the Web – URLs, Schemes, Host Names and Port Numbers – Using the Browser – Hypertext and HTML
Unit-III :	Introduction to Java – Features of Java – Object Oriented Concepts – Lexical Issues – Data Types – Variables – Arrays – Operators
Unit-IV :	Control Statements, Packages – Access Protection – Importing Packages – Interfaces
Unit-V :	Exception Handling – Throw and Throws – Threads – Applets – Java Utilities – Code Documentation.

Computer Laboratory Exercises:

Learn to use Internet Explorer and Netscape Navigator-Creation of E-Mail and sending messages-Chat-Greetings with Pictures

Downloading images-Voice mail service- Search Engines(Search a given topic and produce the details about that topic)- Design a web page of your favourite teacher , explaining his academic and personal facts and give suitable headings and horizontal rules. Design it in appropriate color-Design a web page advertising a product for marketing with charts of sales-Develop discussion forum for the purpose of communication between groups - Develop a page to send a mail to more than one person-Post a simple job site for the facility of the career