SRI KALISWARI COLLEGE,SIVAKASI

(An Autonomous Institution, Affliated to Madurai Kamaraj University,

Reaccredited with 'A' Grade by NAAC with CGPA 3.30)

DEPARTMENT OF MATHEMATICS

Programme Scheme of Examinations and Syllabi

(with effect from June, 2015)

PG Programme – M.Sc. (Mathematics)

Programme Outcome (PO) for Postgraduate Programmes

Knowledge

PO 1: Acquisition of advanced knowledge for higher studies and research.

PO 2: Synthesis of knowledge and critical thinking

Skills

PO 1: Life Skills and Skills for contribution to nation building.

PO 2: Acquisition of specialized skills for entrepreneurship/employability.

Attitude

PO 1: Acquisition of professional ethics and human values.

PO 2: National Integration and Social Commitment to Society.

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Programme Specific Outcome

- Centres on the study and development of techniques to tackle pure and applied mathematical questions.
- The ability to assess and interpret complex situations, choose among several potentially appropriate mathematical methods of solution, persist in the face of difficulty, and present full and cogent solutions that include appropriate justification for their reasoning.
- Engage in life-long learning and professional development through self-study, continuing education or professional studies.
- To impart qualitative inputs to the readers prepaing for the CSIR–JRF examinations.

Sri Kaliswari College (Autonomous)-Sivakasi
Department of Mathematics
Choice Base Credit System- Curriculum Pattern
PG Programme – M-Sc [Mathematics]
2015-2017

Course code	Course Name	Hours	Credits
Semester I			
15PMAC11	**Core – I** : Algebra I	6	4
15PMAC12	**Core – II :** Analysis I	6	4
15PMAC13	**Core – III :** Graph Theory I	6	4
15PMAC14	**Core – IV** : Statistics	6	4
Major Elective I		6	4
15PMAO11	1. Combinatorial Mathematics		
15PMAO12	2. Differential Geometry		
15PMAO13	3. Automata and Formal Languages		
15PMAO14	4. Modern Applied Algebra		
	TOTAL	**30**	**20**
Semester II			
15PMAC21	**Core – V :** Algebra II	6	4
15PMAC22	**Core – VI :** Analysis II	6	4
15PMAC23	**Core – VII :** Differential Equations	6	5
15PMAC24	**Core – VIII :** Mechanics	6	5
Major Elective II		6	4
15PMAO21	1. Numerical Analysis		
15PMAO22	2. Graph Theory II		
15PMAO23	3. Fuzzy Analysis		
15PMAO24	4. Stochastic Processes		
	TOTAL	**30**	**22**
Semester III			
15PMAC31	**Core – IX :** Field Theory and Lattices	6	4
15PMAC32	**Core – X :** Measure Theory	6	4
15PMAC33	**Core – XI :** Functional Analysis	6	5
15PMAC34	**Core – XII :** Topology	6	5
Non - Major Elective II		6	4
15PMAN31	1. Bio Statistics		
15PMAN32	2. Business Statistics		
15PMAN33	3. Quantitative Aptitude		
	TOTAL	**30**	**24**

Semester IV			
15PMAC41	**Core – XIII :** Complex Analysis	6	4
15PMAC42	**Core – XIV :** Number Theory and Cryptography	6	4
15PMAC43	**Core – XV :** Operations Research	6	5
15PMAJ41	**Core – XVI :** Project	6	5
Major Elective III		6	4
15PMAO41	1. Microsoft Visual Basic		
15PMAO42	2. Advanced Functional Analysis		
15PMAO43	3. Advanced Statistics		
15PMAO44	4. Advanced Topology		
	TOTAL	**30**	**24**

Semester	**I**	**II**	**III**	**IV**	**Total**
Credits	20	22	24	24	90

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Core – I : Algebra – I – 15 PMAC11 **Duration: 90 Hrs**
Credits : 4

Aim and Objectives:

- To recognize the abstract approach of mathematics.
- To introduce the important current research areas in algebra.
- To see the development of some important algebraic systems like groups, rings.

Course Outcome :

- Learn the concepts and develop the working knowledge on Groups, Normal Subgroups, Automorphism groups, Finite groups and Rings.
- Understand the concepts and develop the working knowledge on class equation, solvability of groups and finite abelian groups .
- Knowledge about Group Theory and Ring Theory mainly, the Sylow's
- theorems and polynomials rings.
- Understand the concepts of group, ring, field, homomorphism, isomorphism, and quotient structure, and to apply some of these concepts to real world problems.
- Knowledge about direct product of groups, Structure of finite abelian groups.
- Knowledge about Ring of polynomials, prime, irreducible elements and their properties, UFD, PID and Euclidean domains. prime ideal, maximal ideals.
- Knowledge about various algebraic structures.
- Establish the algebraic concept to apply in other disciplines.

Unit I **(18 Hrs)**

A Counting Principle – Normal Subgroups and Quotient Groups - Another Counting Principle - Sylow's Theorem.

Unit II **(18 Hrs)**

Direct Products – Finite Abelian Groups.

Unit III **(18 Hrs)**

Ideals and Quotient Rings – More Ideals and Quotient Rings – The Field of Quotients of an Integral Domain.

Unit IV **(18 Hrs)**

Euclidean Rings – A particular Euclidean Ring.

Unit V **(18 Hrs)**

Polynomial rings–Polynomials over the rational field–Polynomial rings over Commutative Rings.

Text Book:

I.N. Herstein , “Topics in Algebra”, John Wiley and Sons, Singapore, Second Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Core – II : Analysis – I – 15 PMAC12 **Duration: 90 Hrs**
Credits : 4

Aim and Objectives:

- To develop the real number system as an ordered fields.
- To study the applications of least upper bound and greatest lower bound property.
- To enrich the knowledge of the sequences in Euclidean spaces and in metric spaces.
- To discuss vector valued functions.

Course Outcome :

- Learn the basic ingredients of reals.
- Study the properties of functions defined on the Real line.
- Exhibit knowledge of relevant definitions, techniques and mathematical results.
- Develop a sound knowledge and appreciation of the ideas and concepts related to metric spaces
- Give a strong foundation to take up advanced level courses in analysis.
- Make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- Demonstrate compactness, Completeness, limits, continuity.
- Get the analytical skill about continuity and derivability.
- Inculcate the basic knowledge of differentiation, expansion of functions and their applications.

Unit I **(18 Hrs)**

The existence theorem of the real field(not for the examination) – Archimedean property of R – The existence of nth roots of positive reals – Finite –Countable and uncountable Sets – Metric Spaces.

Unit II **(18 Hrs)**

Compact Sets –Perfect Sets –Connected Sets – Convergent sequences – Subsequences – Cauchy sequences – Upper and Lower Limits – Some special sequences.

Unit III **(18 Hrs)**

Series – Series of Non - negative Terms – The Number e –The Root and Ratio tests – Power Series – Summation By Parts – Absolute Convergence –Addition and Multiplication of Series – Rearrangements

Unit IV **(18 Hrs)**

Limits of Functions – Continuous Functions – Continuity and Compactness –Continuity and Connectedness – Discontinuities – Monotonic Functions –Infinite Limits and Limits at Infinity

Unit V **(18 Hrs)**

The Derivative of a Real Function –Mean Value Theorems – The Continuity of Derivatives – L'Hospital's rule –Derivatives of Higher order – Taylor's theorem – Differentiation of Vector Valued Functions

Text Book:

Walter Rudin' "Principles of Mathematical Analysis", Mcgraw Hill Book Company, Singapore , third Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Core – III : Graph Theory– I – 15PMAC13 **Duration: 90 Hrs**
Credits : 4

Aim and Objectives:

- To study the application of graph theory to real world.
- To study the theoretical treatment of graph theory.
- To strengthen the ideas and point the way to independent applications in science.

Course Outcome :

- Write precise and accurate mathematical definitions of objects in graph theory
- Able to formulate problems in terms of graphs, solve graph theoretic problems and apply algorithms taught in the course
- Know when a connected graph is a tree and how trees arise in applications
- Prove Euler's result on Eulerian graphs
- Able to formulate Dual graphs
- Explain basic terminology of a graph
- Identify Euler and Hamiltonian cycle
- Represent graphs using adjacency matrices
- Know about many different coloring problems for graphs.
- Able to study the graph concepts in directed graphs

Unit I **(18 Hrs)**

Graphs and Simple Graphs – Graph isomorphism – The incidence and Adjacency matrices – Sub graphs – Vertex degrees – Paths and Connection – Cycles – Trees- Cut edges and Bonds – Cut vertices – Cayley's formula.

Unit II **(18 Hrs)**

Connectivity – Blocks – Euler Tours – Hamilton Cycles.

Unit III **(18 Hrs)**

Matchings - Matchings and Coverings in Bipartite Graphs – Perfect Matchings – Edge chromatic Number – Vizing's Theorem.

Unit IV **(18 Hrs)**

Independent sets –Chromatic Number – Brooks' Theorem – Chromatic polynomials – Girth and Chromatic Number.

Unit V **(18 Hrs)**

Plane and Planar Graphs - Dual Graphs – Euler's Formula– Directed Graphs – Directed Paths – Directed Cycles.

Text Book:

J.A.Bondy and U.S.R.Murty, "Graph theory with Applications", The Macmillan press Ltd, Great Britain.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Core – IV : Statistics – 15PMAC14 **Duration: 90 Hrs**
Credits : 4

Aim and Objectives:

- To introduce the concept of set theory, probability set function.
- To study about the binomial and related distributions.
- To know about sampling theory and convergence of distributions.

Course Outcome :

- Apply the specialised knowledge in set theory and probability set function.
- Demonstrate ability to use formal mathematical argument in the context of conditional distributions and expectations
- Understand the binomial and related distributions
- Gain knowledge about various distributions like the Gamma and Chi-square distributions ,the normal distribution ,the bivariate normal distribution.
- Introduce the concept of sampling theory.
- Present the ideas about the Beta, t, and F distributions
- Evaluate the concept of moment generating function technique
- Learn the concept of Limiting moment generating functions
- Formulate and analyze mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions using various discrete distributions and estimation theory techniques.
- Use statistical techniques to solve well-defined problems and present their mathematical work, both in oral and written format.

Unit I **(18 Hrs)**

Introduction – set theory – The probability set function – Conditional probability and independence – Random variables of the discrete type – Random variables of the continuous type –Properties of the Distribution function – Expectation of a random variable – Some special expectations –Chebyshev's inequality.

Unit II **(18 Hrs)**

Distributions of two random variables – Conditional distributions and expectations – The correlation coefficient – Independent random variables – Extension to several random variables.

Unit III **(18 Hrs)**

The binomial and related distributions – The Poisson distribution – The Gamma and Chi-square distributions – The normal distribution – The bivariate normal distribution.

Unit IV **(18 Hrs)**

Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type –The Beta, t, and F distributions – Extensions of the change-of-variable technique –Distributions of order Statistics – The moment generating function technique – The distributions of $\overline{X}$ and $\frac{ns^2}{\sigma^2}$ – Expectations of functions of random variables.

Unit V **(18 Hrs)**

Convergence in distribution - Convergence in probability - Limiting moment generating functions - The central limit theorem - Some theorems on limiting distributions.

Text book:

Robert V. Hoff and Allen T. Craig, " Introduction to Mathematical Statistics" , Pearson Education Pvt. Ltd., Singapore, V Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Major Elective I : Combinatorial Mathematics – 15PMAO11 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To use combinatorial mathematics for solving problems which occur in engineering and operations research.
- To learn more about permutations, combinations and recurrence relations.

Course Outcome :

- Learn about the use of generating functions for enumeration of combinatorial structures, including partitions of numbers, permutations with restricted conditions.
- Study the solution of recurrence relations; methods of enumeration with restricted conditions.
- Comprehend the features characterizing problems in combinatorial mathematics;
- Develop skills required to analyze and solve problems in combinatorial mathematics;
- Appreciate the overlap between mathematics and other areas of applied and pure mathematics.
- An improved ability to communicate mathematical ideas.
- Describe and explain theories, design principles and empirical results in the area of specialization.
- Apply the ideas in real life situations.
- Know to classify the counting.

Unit I **(18Hrs)**

Introduction - The Rules of sum and Product- Permutations- Combinations- Distributions of distinct objects - Distributions of non distinct objects

Unit II **(18Hrs)**

Introduction-Generating Functions for combinations- Enumerators for permutations- Distributions of distinct objects into non distinct cells- Partitions of integers- Elementary relations

Unit III **(18Hrs)**

Introduction- Linear recurrence relations with constant coefficients- Solution by the technique of generating functions- Recurrence relations with two indices

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Unit IV **(18Hrs)**

Introduction- The Principle of inclusion and exclusion – The general formula - Derangements - Permutations with restrictions on relative positions

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Unit V **(18Hrs)**

Introduction- Equivalence classes under a permutation group- Equivalence classes of functions- Weights and inventories functions - Polya's fundamental theorem- Generalization of Polya's theorem.

Text book:

C.L.Liu , "Introduction to combinatorial mathematics" , Mcgraw Hill Book Company, Singapore , 1968.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Base Credit System
PG Programme – M.Sc (Mathematics) – 2015-2017
Semester – I

Major Elective – I : Differential Geometry – 15PMAO12 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To discuss the classical theory of curves and surfaces using vector methods
- To introduce the essential ideas and methods of differential geometry

Course Outcome :

- Explain the concepts and language of differential geometry and its role in modern mathematics.
- Demonstrate the contact between curves and surfaces.
- Know about the surfaces of revolution.
- Parametrize a plane and a space curve and to calculate its curvatures and Frenet-Serret apparatus and arc-length
- Gain knowledge of families of curves.
- Present the concept of Geodesic and their properties.
- Identify the principle of curvature of a curve.
- Understand the developable associated with space curves
- Able to know the minimal and ruled surfaces.

Unit I **(18 Hrs)**

Introductory remarks about space curves – Definitions – Arc length – Tangent, normal and binormal – Curvature and torsion of a curve given as the intersection of two surfaces – Contact between curves and surfaces – Tangent surface ,involutes and evolutes.

Unit II **(18 Hrs)**

Intrinsic equations, fundamental existence theorem for space curves – Helices –Definition of a surface – Curves on a surface – Surfaces of revolution – Helicoids.

Unit III **(18 Hrs)**

Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties – Geodesics – Canonical Geodesic equations – Normal property of geodesics.

Unit IV **(18 Hrs)**

The second fundamental form – Principal curvature – Lines of curvature – Developables – Developables associated with space curves – Developables associated with curves on surfaces

Unit V **(18 Hrs)**

Minimal surfaces – Ruled surfaces – The fundamental equations of surface theory – Parallel surfaces – Fundamental existence theorem for surfaces

Text Book:

T.J.Willmore , “An Introduction to Differential Geometry”, Oxford University Press, New Delhi, 2006.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester I

Major Elective – I :Automata & Formal Languages – 15PMAO13 Duration : 90 Hrs
Credits : 4

Aim and Objectives:

- To know about the concept of Automata theory.
- To study about the applications of context-free grammar.

Course Outcome :

- Prove properties of languages, grammars and automata with rigorously formal mathematical methods.
- Design automata, regular expressions and context-free grammars accepting or generating a certain language.
- Describe the language accepted by automata or generated by a regular expression or a context-free grammar.
- Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
- An ability to design grammars and automata (recognizers) for different language classes.
- An ability to identify formal language classes and prove language membership properties.
- An ability to prove and disprove theorems establishing key properties of formal languages and automata.
- Identify different formal language classes and their relationships.
- Design grammars and recognizers for different formal languages.

Unit I (18 Hrs)

Strings, alphabets, and languages – Graphs and trees – Inductive proofs – Set notation – Relations.

Unit II (18 Hrs)

Finite state systems–Basic definitions–Nondeterministic finite automata–Finite automata with ε–moves–Regular expressions.

Unit III (18 Hrs)

The pumping lemma for regular sets–Closure properties of regular sets–Decision algorithms for regular sets–The Myhill–Nerode theorem and minimization of finite automata

Unit IV **(18 Hrs)**

Motivation and introduction–Context–free grammars – Derivation trees–Simplification of context-free grammars.

Unit V **(18 Hrs)**

Informal description – Definitions - Pushdown automata and context-free languages

Text Book:

John E.Hopcroff, Jeffery D.Ullman, "Introduction to Automata theory,Languages, and Computation" , Narosa Publishing House, New Delhi, Nineteenth Reprint 2001.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester I

Ma jor Elective – I : Modern Applied Algebra – 15PMAO14 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To study the concept of coding techniques.
- To know about the structure of ALGOL and logic designs.

Course Outcome :

- Demonstrate accurate and efficient use of advanced algebraic techniques
- Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra
- Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts
- Demonstrate accurate and efficient use of advanced algebraic techniques
- Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra
- Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts
- Analyze an application using a function developed from data
- Use the outputs of a Johnson shift counter to generate specialized waveforms utilizing various combinations of the five basic gates.
- Develop a comparison of the Boolean equations and truth tables for the five basic gates.

Unit I **(18 Hrs)**

Introduction – Binary devices and states – Finite-state machines– Covering and equivalence – Equivalent states – A minimization procedure – Turing machines– Incompletely specified machines.

Unit II **(18 Hrs)**

Introduction– Arithmetic expressions– Identifiers: assignment statements– Arrays– For statements– Block structures in ALGOL– The ALGOL grammar– Evaluating arithmetic statements– Compiling arithmetic expressions.

Unit III **(18 Hrs)**

Introduction – Order – Boolean polynomials – Block diagrams for gating networks– Connections with logic– Logical capabilities of ALGOL– Boolean applications– Boolean sub algebras- Disjunctive normal form – Direct products; morphisms.

Unit IV **(18 Hrs)**

Introduction– Optimization – Computerizing optimization – Logic design – NAND gates and NOR gates – The minimization problem – Procedure for deriving prime implicants– Consensus taking– Flip-flops– Sequential machine design.

Unit V **(18 Hrs)**

Introduction – Encoding and decoding – Block codes – Matrix encoding techniques – Group codes – Decoding tables – Hamming codes.

Text Book:

Garrett Birkhoff & Thomas C.Bartee, "Modern Applied Algebra", CBS publishers and Distributors, New Delhi, Reprint 1999.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester II

Core –V : Algebra – II – 15PMAC21 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To recognize the abstract approach of mathematics.
- To introduce the important current research areas in algebra.
- To see the development of some important algebraic system like Vector Spaces.

Course Outcome :

- Inculcate an insight into algebraic structures.
- Demonstrate the vector spaces and the concept of linearity.
- Develop some important algebraic systems like Inner product Spaces.
- Develop an analytic thinking in the concept of linear transformation.
- Learn the Canonical form and Jordan form.
- Provide an introduction to the concept of matrices.
- Give a thorough knowledge of the various aspects of Trace and Transposes.
- Provide the concept of determinants using the operation of matrices.
- Inculcate the basic knowledge of Hermitian and Unitary transformations.
- Illustrate the real and quadratic forms of a matrix.

Unit I **(18 Hrs)**

Elementary basic concepts in vector spaces – Linear independence and bases – Dual spaces.

Unit II **(18 Hrs)**

Inner product spaces – The algebra of linear transformations – Characteristic roots– Matrices

Unit III **(18 Hrs)**

Canonical forms: Triangular form – Nilpotent transformations – A Decomposition of V: Jordan form

Unit IV **(18 Hrs)**

Canonical forms: Rational canonical form – Trace and Transpose

Unit V **(18 Hrs)**

Determinants – Hermitian, Unitary and Normal Transformations – Real Quadratic forms

Text Book:

I.N. Herstein, "Topics in Algebra", John Wiley and Sons, Singapore , Second Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester II

Core – VI : Analysis – II – 15PMAC22 **Duration : 90 Hours**
Credits : 4

Aim and Objectives:

- To introduce integration of real valued functions on interval
- To enrich the knowledge about sequence and series of complex valued functions including real valued functions
- To study about some special functions.

Course Outcome :

- Inculcate an insight into Riemann integration
- Understand the basic concepts underlying the definition of the Riemann integral.
- Understand the statement and proof of the fundamental integral convergence theorems, and their applications.
- Demonstrate the main results on integration and an ability to apply these in examples
- Find the domain, derivatives, and integral of power series and express known functions as power series.
- Identify uniformly and non-uniformly convergent sequences of functions, and apply results related to uniform convergence
- Inculcate the basic knowledge of differentiation, expansion of functions and their applications.
- Provide a good background on advanced analysis

Unit I **(18 Hrs)**

Definition and existence of the Integral – Properties of the Integral – Integration and Differentiation – The fundamental theorem of calculus – Integration by Parts – Integration of Vector Valued functions – Rectifiable curves

Unit II **(18 Hrs)**

Discussion of main problem – Uniform convergence – The Cauchy criterion for uniform convergence – Uniform convergence and continuity – Uniform convergence and integration – Uniform convergence and differentiation – Equicontinuous families of functions – The Stone-Weiertrass Theorem

Unit III **(18 Hrs)**

Power series – The Exponential and Logarthmic functions – The Trigonometric functions – The Algebraic completeness of the complex field – Fourier series – Trigonometric series – Parseval's theorem – The Gamma function – Some consequences – Stirling's formula.

Unit IV **(18 Hrs)**

Linear transformations – Differentiation – Partial derivatives – The contraction principle– The inverse function theorem

Unit V **(18 Hrs)**

The implicit function theorem – The rank theorem – Determinants – Jacobians – Derivatives of higher order – Differentiation of integrals

Text Book:

Walter Rudin , "Principles of Mathematical Analysis", Mcgraw Hill Book Company, Singapore, Third Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics - 2015-2017
Semester II

Core – VII : Differential Equations – 15PMAC23 **Duration : 90 Hrs**
Credits : 5

Aim and Objectives:

- To study about ordinary and partial differential equations
- To know about how to solve the differential equations

Course Outcome :

- Appreciate ODE and system of ODEs concepts that are encountered in the real world
- Work with Differential Equations and systems of Differential Equations in various situations and use correct mathematical terminology, Notation, and symbolic processes in order to engage in work, study, and conversation on topics involving Differential equations.
- Solve exact differential equations, linear differential equations and understand the basics of non -linear differential equations.
- Learn the concepts of series solution of differential equation and solution of Bessel's, Legendre's equations and their properties;
- Formulate and solve partial differential equations arising in a number of practical problems
- Identify an ordinary differential equation and its order and degree
- Determine the general solution of higher order linear equations with constant coefficients
- Determine whether a system of functions is linearly independent using the Wronksian

Unit I **(18 Hrs)**

Introduction – Initial value problems for the homogeneous equation –Solutions of the homogeneous equation – The Wronskian and linear independence – Reduction of the order of a homogeneous equation – The non-homogeneous equation – Homogeneous equations with analytic coefficients – The Legendre equation.

Unit II **(18 Hrs)**

Introduction – The Euler equation – Second order equations with regular singular points- an example- Second order equations with regular singular points – the general case – A convergence proof – The exceptional cases – The Bessel equation – The Bessel equation (continued)

Unit III **(18 Hrs)**

Introduction – Equations with variables separated – Exact equations – The method of successive approximations – The Lipschitz condition – Convergence of the successive

approximations – Non-local existence of solutions – Approximations to- and uniqueness of, solutions.

Unit IV **(18 hrs)**

Partial differential equations – Origins of first – Order partial differential equations – Cauchy's problem for first – Order equations – Linear equations of the first order – Integral surfaces passing through a given curve.

Unit V **(18 Hrs)**

Surfaces orthogonal to a given system of surfaces – Non linear partial differential equations of the First order – Cauchy's method of characteristics –Compatible systems of first-order equations–Charpit's method– Special types of first-order equations.

Text Book :

1. Earl.A .Coddington, "An Introduction to ordinary differential equations", Prentice Hall of India Private Ltd., New Delhi, 2006.

2. I.N. Sneddon, "Elements of Partial Differential equations", McGraw Hill Book Company, Singapore, International Edition 1957.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester II

Core –VIII : Mechanics – 15PMAC24 **Duration : 90 Hrs**
Credits : 5

Aim and Objectives:

- To
- To introduce the study of variational principle formulation of continuous systems and fields.

Course Outcome :

- Analyse mechanical behaviour of particle.
- Obtain simple mathematical and physical relationships between mechanics and materials.
- Achieve mastery in moments and products of Inertia, Equimomental systems.
- Ability to study generalized coordinates, Scleronomic and Rheonomic systems.
- Able to study Lagrange's equations for various systems
- Solve orbit problems using the conservation of angular momentum and total energy.
- Recognize the principles written in form of mathematical equations.
- Able to work out the centre of gravity and moment of inertia of various plane areas.

Unit I **(18 Hrs)**

Mechanics of a particle – Mechanics of a system of particles – Constraints

Unit II **(18 Hrs)**

D'Alembert's principle and Lagrange's equations–Velocity – dependent potentials and the dissipation function – Hamilton's principle – Some techniques of the calculus of variations

Unit III **(18 Hrs)**

Derivation of Lagrange's equations from Hamilton's principle – Extension of Hamilton's principle to non holonomic systems – Advantages of a variational principle formulation– Conservation theorems and symmetry properties

Unit IV **(18 Hrs)**

Reduction to the equivalent one- body problem – The equations of motion and first integrals – The equivalent one- dimensional problem and classification of orbits – The virial theorem

Unit V **(18 Hrs)**

The differential equation for the orbit and integrable power – law potentials– Conditions for closed orbits (Bernard's theorem) – The Kepler problem: Inverse square law of force – The motion in time in the kepler problem–The Laplace-Runge – Lenz vector.

Text Book:

H. Goldstein, " Classical Mechanics" , Second edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester II

Major Elective – II : Numerical Analysis – 15PMAO21 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To apply numerical methods to solve problems in physical & technical applications.
- To use numerical methods for solving first & second degree equation and polynomial equations.
- To know about numerical differentiations and integrations.

Course Outcome :

- Demonstrate understanding of common Numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
- Apply various mathematical operations and tasks, such as interpolation, differentiation, integration, the solutions of linear equations and the solutions of differential equations and partial differential equations.
- Examine approximate solutions to mathematical problems.
- Understand basics of finite precision arithmetic, conditioning of problems and stability of numerical algorithms.
- Solve dense systems of linear equations and least squares problems and have a working knowledge of LU and QR factorizations for these problems.
- Understand and apply appropriate techniques for numerical differentiation and integration.
- Solve initial value problem ordinary differential equations with explicit or implicit methods as appropriate solution.
- Compute eigenvalues and eigenvectors of matrices numerically.
- Increase the accuracy of numerical approximations by extrapolation.

Unit I **(18 Hrs)**

Introduction – Bisection method – Iteration methods based on first degree equation – Iteration methods based on second degree equation – Rate of convergence – General iteration methods –Methods for complex roots – Polynomial equations.

Unit II **(18 Hrs)**

Introduction – Direct methods – Error analysis for direct methods – Iteration methods –Eigen values and eigen vectors – Bounds on eigen values – Jacobi Method for symmetric matrices – Rutihauser method for arbitrary matrices – Power Method

Unit III **(18 Hrs)**

Introduction – Lagrange and Newton interpolations – Finite difference operators – Interpolating polynomials using finite differences – Hermite interpolation – Piecewise and spline interpolation.

Unit IV **(18 Hrs)**

Introduction – Numerical differentiation – Extrapolation methods – Partial differentiation – Numerical integration – Methods based on interpolation – Composite integration methods – Romberg method.

Unit V **(18 Hrs)**

Introduction – Difference equations – Numerical methods – Single step methods.

Text Book:

M.K.Jain, S.R.K.Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Limited, Publishers New Delhi, Sixth Edition, 2012.

Sri Kaliswari College (Autonomous), Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester II

Major Elective – II : Graph Theory – II – 15 PMAO22 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To study the application of graph theory to real world.
- To study the theoretical treatment of graph theory.

Course Outcome :

- Have increased ability in graph theoretic problem solving.
- Able to formulate applied problems as coloring problems.
- Calculate the chromatic number and chromatic index of a given graph
- Apply the Planarity Algorithm
- Calculate the chromatic polynomial of a graph using the algorithm
- Able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.
- Able to solve Turan's problem

Unit I **(18 Hrs)**

The Shortest path problem – Sperner`s Lemma – The connector problem.

Unit II **(18 Hrs)**

Construction of reliable communication networks – The Chinese Postman problem – The travelling salesman problem.

Unit III **(18 Hrs)**

The personnel assignment problem – The optimal assignment problem – The timetabling problem.

Unit IV **(18 Hrs)**

Ramsey`s Theorem – Turan`s Theorem – Schur`s Theorem.

Unit V **(18 Hrs)**

A storage problem – A planarity algorithm – A job sequencing problem.

Text Book:

J.A.Bondy and U.S.R.Murty, "Graph theory with Applications", The Macmillan press Ltd, Great Britain.

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Choice Based Credit System
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Semester II

Major Elective – II : Fuzzy Analysis – 15PMAO23 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives :

- To study about the concept of information under new mathematical formulation

Course Outcome :

- Gain knowledge about constructing the appropriate fuzzy numbers corresponding to uncertain and imprecise collected data.
- Gain knowledge about finding the optimal solution of mathematical programming problems having uncertain and imprecise data.
- Knowledge about fuzzy cluster analysis and how to solve basic problems using fuzzy cluster analysis
- Distinguish between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic function and the fuzzyset membership function
- Draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively.
- Able to define fuzzy sets using linguistic words and represent these sets by membership functions.
- Know fuzzy-set-related notions; such as α-level sets, convexity, normality, support, etc.

Unit I **(18 Hrs)**

Crisp sets and Fuzzy sets –Introduction–Crisp sets: An overview–The notion of Fuzzy sets–Basic concepts of Fuzzy sets

Unit II **(18 Hrs)**

Classical logic: An overview – Fuzzy logic – Crisp and Fuzzy relations –Binary relations – Binary relations on a single set

Unit III **(18 Hrs)**

Equivalence and similarity relations–Compatibility or tolerance relations–Orderings

Unit IV **(18 Hrs)**

Morphisms–Fuzzy relation equations–Fuzzy measures–General discussion–Belief and Plausibility measures

Unit V **(18 Hrs)**

Probability measures–Possibility and necessity measures–Relationship among classes of fuzzy measures–Types of uncertainty–Measures of fuzziness

Text Book:

George J.Klir and Tina A.Folger, “Fuzzy sets, Uncertainty and information”.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
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Semester II

Major Elective –II : Stochastic Processes – 15 PMAO24 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To introduce the concept of Stochastic Process
- To study about Special chains and Foster type theorems
- To know about Poisson process and renewal theory

Course Outcome :

- Apply the specialised knowledge in probability theory and random processes to solve practical problems.
- Gain advanced and integrated understanding of the fundamentals of and interrelationship between discrete and continuous random variables and between deterministic and stochastic processes.
- Analyse the performance in terms of probabilities and distributions achieved by the determined solutions.
- Demonstrate essential stochastic modelling tools like Markov chains .
- Evaluate the n-step transition probability.
- Learn about renewal theory.
- Demonstrate the transition function
- Know about the Birth – Death and Yule process
- Study the properties of Poission process and their characterization.
- Understand the relationship between the purpose of a model and the appropriate level of complexity and accuracy.

Unit I **(18 Hrs)**

Definition and transition probabilities – A few more examples – Classification of states – Limit theorems for Markov Chains – Stationary distribution

Unit II **(18 Hrs)**

Special chains and Foster type theorems – Theorems regarding finite Markov chains – Methods of evaluation of the n-step transition probability

Unit III **(18 Hrs)**

Introduction – Renewal equation –Renewal theorems – Central limit theorem for renewal theory

Unit IV **(18 Hrs)**

Axiomatic definition and transition function – Differentiability of transition function – Kolmogorov differential difference equation – Infinitesimal generators and examples– Birth and death processes – The Yule process

Unit V **(18 Hrs)**

Different definitions and their equivalence – Poisson process and renewal theory – Properties of Poisson process – Characterization of Poisson process – Generalization of Poisson process

Text Book:

A.K.Basu, "Introduction to Stochastic Process", Narosa publishing house, New Delhi, Second Reprint 2007.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester III

Core – IX : Field Theory and Lattices – 15PMAC31 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To recognize the abstract approach of Mathematics.
- To see the development of some important algebraic systems like, field, Solvable groups, Galois groups etc.

Course Outcome :

- Inculcate the basic knowledge of extension fields.
- Learn the concept of splitting field and its properties.
- Develop the famous theory of field extension, the Galois Theory of polynomial equations.
- Gain knowledge of solvable group by radicals.
- Understand the relation between symmetric roots of a polynomial and its solvability.
- Study about finite fields and its properties.
- Gain an in-depth knowledge of finite fields using general theorems like wedderburns theorem, Jacobson theorem and square theorem.
- Introduce a new algebraic structure namely Lattices using partially ordered sets.
- Study the types of lattices and the concept of Boolean algebras.

Unit I **(18 Hrs)**

Extension Fields – Algebraic Extension – The Transcendence of e – Roots of Polynomials – Splitting Fields.

Unit II **(18 Hrs)**

Construction with straightedge and compass – More about roots – Simple Extension – The Elements of Galois Theory – Normal Extension.

Unit III **(18 Hrs)**

Solvability by Radicals – Solvable Group – Galois groups over the rationals.

Unit IV **(18 Hrs)**

Finite fields – Wedderburn's Theorem on finite division rings – Jacobson Theorem – A Theorem of Frobenius – Integral Quaternions and the Four-square Theorem – Lagrange Identity.

Unit V **(18 Hrs)**

Partially Ordered Sets – Lattices – Modular lattices – Schrier's theorem .The chain conditions – Decomposition theory for lattices with ascending chain condition – Independence – Complemented modular lattices – Boolean Algebras.

Text Books:

1. I.N.Herstein, "Topics in Algebra", John Wiley and Sons, Newyork, Second Edition.

2. Nathan Jacobsen, " Lectures in Abstract Algebra", Affiliated East-West Press Pvt.Ltd, New Delhi, Volume I – First Edition April 1951.

Sri Kaliswari College (Autonomous), Sivakasi
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Semester III

Core – X : Measure Theory – 15PMAC32 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To enrich the students with the knowledge of basic results and an ability to apply them
- To develop the ideas which lie in analysis, geometry and probability

Course Outcome :

- Learn the concept and properties of measure starting with outer measure and then the Lebesgue measure.
- Study measurable sets and measurable functions and their properties.
- Understand the basic concepts underlying the definition of the general Lebesgue integral
- Study spaces of measurable Lebesgue integrable functions.
- Understand Lebesgue integral and its relation with Riemann integral
- Apply the theory of the course to solve a variety of problems at an appropriate level of difficulty.
- Build a good background for more advanced analysis
- Exhibit knowledge of relevant definitions, techniques and mathematical results.

Unit I **(18 Hrs)**

Lebesgue outer measure – Measurable sets – Regularity.

Unit II **(18 Hrs)**

Measurable functions – Borel and Lebesgue measurability.

Unit III **(18 Hrs)**

Integration of non-negative functions – The general integral – Integration of series.

Unit IV **(18 Hrs)**

Riemann and Lebesgue integrals – The four derivatives – Continuous non-differentiable functions.

Unit V **(18 Hrs)**

Functions of bounded variation – Lebesgue's differentiation theorem –Differentiation and integration – The Lebesgue set.

Text Book:

G.de Barra,"Measure theory and integration", New Age International (P) Limited, Publishers, New Delhi, First Edition

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Choice Based Credit System
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Semester III

Core – XI : Functional Analysis – 15PMAC33 **Duartion : 90 Hrs**
Credits : 5

Aim and Objectives:

- To know about the fundamentals of normed spaces
- To study about bounded linear maps on Banach spaces
- To study about spaces of bounded linear functionals

Course Outcome :

- Gain an insight into normed space.
- Understand the concept of continuity and boundedness of linear maps
- Study the characterization of Hahn – Banach Theorem.
- Gain knowledge of central concepts of the open mapping and closed graph theorems.
- Demonstrate the Bounded Linear maps on Banach spaces
- Present the uniform boundedness principle on Banach spaces.
- Learn about Spectrum of a bounded operator
- Evaluate the spectral radius formula
- Demonstrate the concept of weak and weak* convergence
- Able to get idea of reflexivity using Helly's theorem and Milman theorem

Unit I **(18 Hrs)**

Fundamentals of normed spaces – Normed spaces – Riesz lemma –Continuity of linear maps– Bounded linear maps.

Unit II **(18 Hrs)**

Hahn-Banach theorems: Hahn-Banach Separation theorem – Hahn-Banach Extension theorem– Unique Hahn-Banach Extensions –Banach spaces.

Unit III **(18 Hrs)**

Bounded linear maps on Banach spaces: Uniform boundedness principle – Banach Steinhaus theorem- Resonance theorem

Closed graph and open mapping theorems: Closed graph theorem – open mapping theorem.

Unit IV **(18 Hrs)**

Bounded inverse theorems– Two norn theorem- Spectrum of a bounded operator – Neumann Expansion- Spectral radius formula– Duals and transposes.

Unit V **(18 Hrs)**

Duals of L^p([a,b]) and C ([a,b]): Riesz representation theorem for L^p - Riesz representation theorem for C ([a,b]) – Weak and weak* convergence

Reflexivity: Helly's theorem – Milman theorem.

Text Book:

Balmohan V Limaye,"Functional Analysis", New Age International (P) Limited, Publishers,New Delhi , Second edition.

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Semester III

Core – XII : Topology – 15PMAC34 **Duration : 90 Hrs**
Credits : 5

Aim and Objectives:

- To introduce the concept of topological spaces
- To study about Connectedness and Compactness in topological spaces
- To know about Countability and separation axioms

Course Outcome:

- Learn the basic concepts of topology
- Become competent in writing proofs
- Gain knowledge about the fundamental groups and covering spaces.
- Able to work new ideas with Mathematics.
- Gain knowledge about topological examples and counterexamples
- Establish an introduction to the field of topology, with emphasis on those aspects of the subject that are basic to higher mathematics.

Unit I **(18 Hrs)**

Topological spaces – Basis for a topology – The order topology – The product topology on X × Y – The subspace topology - Closed sets and limit points – Continuous functions.

Unit II **(18 Hrs)**

The product topology – The metric topology – The metric topology (continued) – Connected spaces – Connected subspaces of the real line – Components and local connectedness.

Unit III **(18 Hrs)**

Compact spaces – Compact subspaces of the real line – Limit point compactness – Local compactness.

Unit IV **(18 Hrs)**

The Tychonoff Theorem – The countability axioms – The separation axioms – Normal spaces.

Unit V **(18 Hrs)**

The Urysohn lemma – The Urysohn metrization theorem – The Tietze extension theorem.

Text Book :

James R. Munkres ,"Topology", Prentice Hall of India Private Limited, New Delhi, Second Edition.

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Semester III

Non Major Elective –I : Bio Statistics – 15 PMAN31 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To introduce the application of statistical methods to the problems of biology.
- To study a predictable error and to ascertain the reality of minute but important differences.

Course Outcome :

- Demonstrate an understanding of the properties of probability and probability distributions and their role as the foundation for statistical inference.
- Demonstrate an ability to use formal mathematical argument in the context of probability and statistics.
- Understand sampling distributions of sample means and sample proportions
- Estimate a population mean and a population proportion from a sample
- Evaluate the accuracy of sample estimates using standard errors
- Evaluate interpret margins of error for both qualitative and quantitative data
- Identify the use of confidence intervals and hypothesis tests
- Gain knowledge about statistical significance.
- Distinguish marginal, joint, and conditional probabilities
- Understand and apply the concept of independence of events.

Unit I **(18 Hrs)**

Variables and Constants – Population and Samples – Random Samples – Discrete and continuous variables – Relationship and Predictions – Variables in Biology – Derived variables, ratio index and rates - Levels of Measurements of Biological Data – Parameters and Statistic – Accuracy and Precision – Accuracy in a set of observation – Levels of measurements and problems of statistical treatment – Units of Observations – The Summation Sign

Unit II **(18 Hrs)**

Tabulation – Frequency Table or Frequency distribution – Preparation of a frequency table – Relative frequency distribution – Cumulative frequency distribution

Unit III **(18 Hrs)**

Graphical Representation of Statistical Data – Types of Graphs – Modes of Graphical representation of data – Line Graph – Bar diagram – Pie Chart or Circle Chart or Sector

Chart – Pictograph – Pictogram – Graphical representation of grouped data – Histogram – Frequency Polygon – Frequency curve – Cumulative frequency curve on Ogive – Proportional change diagram – Arithlog or Ratio Diagrams

Unit IV **(18 Hrs)**

Central tendency or Average – Arithmetic mean – Median – Mode – Other measures of Central tendency – Comparision of the mean, median and mode – Percentiles, Quartiles and Percentile Ranks

Unit V **(18 Hrs)**

Variability – Range – Inter-quartile range – Average Deviation or Mean
Deviation – Methods for calculation of mean deviation – Standard Deviation – Computation of Standard Deviation

Text book:

Dr. P.N. Arora & Mr. P.K. Malhan," Bio Statistics", Himalaya Publishing House, Mumbai , First Edition Reprint 2001

Sri Kaliswari College (Autonomous)-Sivakasi
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Semester III

Non Major Elective – I : Business statistics – 15PMAN32 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To introduce the basic concept of Statistics
- To study about Measures of central tendency, dispersion and skewness
- To know about Index numbers

Course Outcome :

- Enhance the knowledge of statistics in business management.
- Develop analytical skills in both private and public business organics in the country.
- Build a culture of informed decision making using statistical models
- Describe data with descriptive statistics
- Perform statistical analyses
- Interpret the results of statistical analyses
- Make inferences about the population from sample data.
- Calculate and apply measures of location and measures of dispersion --grouped and ungrouped data cases.
- Apply discrete and continuous probability distributions to various business problems.
- Analyze and understand the meaning of the measures of central tendency: mean, median and mode

Eligibility: Any student from any programme can be admitted.

Unit I **(18 Hrs)**

Measures of central Value – Introduction – Objectives of averaging – Requisites of a good average – Types of averages –Arithmetic Mean – Calculation of simple arithmetic mean-individual observations – Calculation of arithmetic mean-discrete series - Calculation of arithmetic mean-continuous series – Calculation of arithmetic mean in case of open end classes – Mathematical properties of Arithmetic mean – Merits and Limitations of Arithmetic Mean – Weighted arithmetic mean – Median – Calculation of median-individual observations – Computation of median-discrete series – Calculation of median-continuous series – Calculation of median when class intervals are unequal – Mathematical property of median – Merits and limitations of median – Related positional measures – Computation of quartiles, percentiles, etc – Determination of median, quartiles, etc., graphically – Mode – Calculation of mode- individual observations – Calculation of mode- discrete series – Calculation of mode- continuous series – Mode when class intervals are unequal – Locating mode graphically – Merits and limitations of mode – Relationship among mean, median, and mode – Geometric mean – Properties of geometric mean – Calculation of geometric mean-individual observations - Calculation of geometric mean-discrete series - Calculation of

geometric mean-continuous series – Uses of geometric mean – Compound interest formula – Weighted geometric mean – Merits and limitations of geometric mean – Harmonic mean – Calculation of Harmonic mean-individual observations – Calculation of Harmonic mean– discrete series – Calculation of Harmonic mean-continuous series – Uses of Harmonic mean – Merits and limitations of Harmonic mean – Relationship among the averages.

Unit II **(18 Hrs)**

Measures of dispersion – Introduction – Significance of measuring variations – Properties of a good measure of variation – Methods of studying variations – The interquartile range or the quartile deviation – Merits and limitations – The mean deviations – Calculation of mean deviations-continuous series – Merits and limitations - Standard deviation – Difference between mean devivation and standard deviation – Calculation of standard deviation - Merits and limitations – Lorenz curve – Difference between dispersion and skewness – Tests of skewness – Measures of skewness – Absolute measures of skewness – Relative measures of skewness – Karl Pearson's coefficient of skewness – Bowley's coefficient of skewness – Kelly's coefficient of skewness

Unit III **(18 Hrs)**

Correlation analysis – Introduction – Significance of the study of correlation – Correlation and causation – Types of correlation – Methods of studying correlation – Scatter diagram method – Merits and limitations of the method – Graphic method – Karl Pearson's coefficient of correlation – Direct method of finding out correlation coefficient – Calculation of correlation coefficient when change of scale and origin is made – Calculation of correlation coefficient when deviations are taken from an assumed mean – Correlation of grouped data – Assumption of the Pearsonian coefficient – Merits and limitations of the Pearsonian coefficient – Interpreting coefficient of correlation – coefficient of correlation and probable error – Conditions for the use of probable error – Coefficient of determination – Properties of the coefficient of correlation – Rank correlation coefficient – Features of Spearman's correlation coefficient – Merits and limitations of the rank method – Concurrent deviation method - Merits and limitations of concurrent deviation method – Calculation of correlation in time series – Correlation of long term changes – Calculation of correlation in short term changes or oscillation

Unit IV **(18 Hrs)**

Index numbers – Introduction – Uses of index numbers – Classification of index numbers – Problems in the construction of index numbers - Methods of constructing index numbers – Unweighted index numbers – Weighted Index numbers – Weighted average of relatives - Quantity or volume index numbers – Value index number – Tests of adequacy of index number formulae – The chain index numbers – Steps in constructing a chain index – Base shifting, Splicing and Deflating the index numbers – Consumers price index numbers – Meaning and need – Method of constructing the index – Index number of industrial production.

Unit V **(18 Hrs)**

Analysis of time series – Introduction – Utility of time series analysis – Components of time series – Preliminary adjustment before analyzing time series – Measurement of Trend –

Freehand or Graphic method – Merits and limitations – Method of semi-averages - Merits and limitations – Method of moving averages - Merits and limitations – The method of least squares – Measuring trends by logarithms – Shifting the trend origin – Conversion of annual trend values to monthly values – Measurement of personal variations – Method of simple average – Ratio-to-trend method – Ratio-to-moving average method – Link relative method – Use and limitations of seasonal index

Text Book:

S.P.Gupta, "Statistical Methods", Sultan Chand & Sons, New Delhi, Forty First Revised Edition, 2011.

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Semester III

Non Major Elective – I : Quantitative Aptitude – 15PMAN33 **Duration : 90 Hrs**
Credits : 4

Aim and objectives:

- To prepare for competitive examination
- To improve arithmetical ability

Course Outcome :

- Be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
- Understand the properties of proportion and how to use them.
- Be able to add, subtract, multiply and divide whole numbers, decimal numbers and fractions.
- Manipulate equations and formulas in order to solve for the desired variable.
- Be able to perform operations with surds and indices.
- Determine the square roots, cube roots of positive whole numbers, decimals and common fractions.

Unit I **(18 Hrs)**

H.C.F and L.C.M of numbers – Decimal Fractions – Simplification – Average – Problems on Numbers – Problems on Ages.

Unit II **(18 Hrs)**

Percentage – Profit and loss – Ratio and proportion – Partnership – Time and Work – Time and Distance

Unit III **(18 Hrs)**

Problems on Trains – Allegation of Mixture – Simple interest – Compound interest

Unit IV **(18 Hrs)**

Calendar – Clocks – Stocks and shares – Permutation and Combinations

Unit V **(18 Hrs)**

Probability - Heights and Distances – Odd man out and series

Text Book:

R.S.Aggarwal," Quantitative Aptitude", S.Chand & Company Ltd.Ram Nagar, New Delhi, Seventh Revised Edition 2011.

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Choice Based Credit System
PG Programme - M. Sc Mathematics-2015-2017
Semester IV

Core – XIII : Complex Analysis – 15PMAC41 **Duration : 90 Hrs**
Credits : 4

Aim and Objectives:

- To assist the students in learning fundamental ideas and theorems about complex plane
- To enrich their knowledge in complex integration

Course Outcome:

- Introduce the concept of Analytic Function, rational function etc.,
- Inculcate an insight into the characterization of some special series
- Describe and parameterize curves and regions in two-dimensional space
- Study about the families of circles
- Evaluate fundamental theorem of calculus and Cauchy's integral formula
- Find the Taylor series of a function and determine its circle or annulus of convergence
- compute the residue of a function and use the residue theory to evaluate a integral over the real line
- Understand the concept of reflection principle
- Learn about Partial fractions.
- Demonstrate the concept of Infinite products-Canonical products

Unit I **(18 Hrs)**

Introduction to the concept of Analytic Function–Limits and Continuity–Analytic Functions–Polynomials–Rational functions–Elementary Theory of Power series–Sequences-Series–Uniform convergence–Power series–Abel`s limit Theorem–The exponential and trigonometric functions–The exponential–The trigonometric functions–The Periodicity–The logarithm.

Unit II **(18 Hrs)**

Conformality–Arcs and closed curves–Analytic functions in regions–Conformal mapping–Length and area– Linear transformations–The linear group–The cross ratio–Symmetry–Oriented circles–Families of circles.

Unit III **(18 Hrs)**

Fundamentals Theorems – Line integrals– Rectifiable arcs– Line integrals as functions of arcs – Cauchy`s Theorem for a rectangle – Cauchy`s Theorem in a disk – Cauchy's integral

formula–The index of a point with respect to a closed curve– The integral formula–Higher derivatives– Local properties of analytic functions-Removable singularities. Taylor`s Theorem–Zeros and poles–The local mapping –The maximum principle.

Unit IV **(18 Hrs)**

The General form of Cauchy's Theorem – Chains and cycles –Simple connectivity – Homology –The general statement of Cauchy's Theorem – Proof of Cauchy's Theorem – The calculus of residues –The residue Theorem –The argument principle –Evaluation of definite integrals –Harmonic functions –Definition and Basic properties –The mean value property– Poisson`s formula –Schwarz`s Theorem –The reflection principle.

Unit V **(18 Hrs)**

Power series expansions –Weierstrass`s Theorem –The Taylor series – The Laurent series – Partial fractions and factorization – Partial fractions-Infinite products –Canonical products– The Gamma function –Stirling`s formula.

Text Book:

L.V.Ahlfors , "Complex Analysis", Mc Graw Hill Book Company, New Delhi, III edition

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Semester IV

Core – XIV : Number Theory and Cryptography – 15 PMAC42 Duration: 90 Hrs
Credits : 4

Aim and Objectives:

- To see the Varity of topics in Number Theory
- To solve problems which has fascinated to professional and amateur mathematicians.
- To study cryptology as an application of Number Theory.
- To learn about Sigma and Tau functions

Course Outcome :

- Solve problems in elementary number theory
- Able to effectively express the concepts and results of Number Theory.
- Apply elementary number theory to cryptography
- Understand the mathematical ideas underlying the theory of error- detection and error-correction using linear codes.
- Apply the theory of error-detecting and error-correcting codes.
- Understand the mathematical ideas underlying the theory of cryptography.
- Apply the theory of cryptography.
- Able to understand the logic and methods behind the major proofs in Number Theory.
- Able to understand the principles and theory of error-correcting codes, and the various methods for constructing them.

Unit I (18 Hrs)

Preliminaries: Introduction – Conjectures, Theorems, and Proofs – Well-ordering and Induction – Sigma Notation and Product Notation – Binomial coefficients– Greatest integer function- Divisibility: Introduction – Divisibility, Greatest Common Divisor, Euclid's Algorithm – Least Common Multiple – Representations of integers –
Primes: Introduction – Primes, Prime counting function- Prime number theorem – Sieve of Eratosthenes, Canonical factorization, Fundamental theorem of arithmetic.

Unit II (18 Hrs)

Congruences: Introduction – Congruences and Equivalence Relations – Linear congruence- Linear Diophantine equations and Chinese remainder theorem – Polynomial congruence– Modular arithmetic – Fermat's theorem – Wilson's theorem and Fermat Numbers – Pythagorean equation.

Unit III **(18 Hrs)**

Arithmetic functions: Introduction – Sigma Function, Tau Function, Dirichlet product-Dirichlet inverse, Mobius function, Euler`s function, Euler`s theorem.

Unit IV **(18 Hrs)**

Primitive roots: Introduction – Definition and Properties – Existence – Indices
Quadratic congruences: Introduction – Quadratic residues and the Legendre symbol – Gauss' Lemma and the Law of quadratic reciprocity.

Unit V **(18 Hrs)**

Cryptology: Introduction- Character ciphers- Block ciphers.

Text Book:

Neville Robbins, " Beginning Number Theory", Jones and Bartlett Publishers, Sudbury, Second Edition, 2006

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PG Programme - M.Sc Mathematics -2015-2017
Semester IV

Core – XV : Operations Research – 15PMAC43 **Duration : 90 Hrs**
Credits : 5

Aim and Objectives:

- To study about network optimization algorithms
- To know about the measures of performance for some queuing models
- To study about nonlinear programming algorithms

Course Outcome :

- Learn the applications of shortest route algorithm
- Gain knowledge of Queuing model.
- Relate the exponential and Poisson distribution
- Present the idea of servicing models
- Demonstrate the Aspiration Level Model.
- Learn the necessary and Sufficient Conditions of Unconstrained problems
- Understand the concept of Direct Search Method of Quadratic Programming.
- Able to know Linear Combinations method and SUMT Algorithm.

Unit I **(18 Hrs)**

Network definitions – Minimal spanning tree algorithm – Shortest route problem – Examples of the Shortest route Applications - Shortest route Algorithms – Linear Programming Formulation of the Shortest route problem – Maximal flow model – Enumeration of cuts - Maximal flow Algorithms - Minimum-cost capacitated flow problem – Network Representation - Linear Programming Formulation – Capacited Network Simplex algorithm - CPM and PERT – Network Representation – Critical Path Computations – Construction of the Time Schedule - Linear Programming Formulation of CPM – PERT Networks .

Unit II **(18 Hrs)**

Why study queues? – Elements of a queuing model – Role of exponential distribution – Pure birth and death models (Relationship between the exponential and Poisson distributions) Pure birth model – Pure death model – Generalized Poisson queuing model.

Unit III **(18 Hrs)**

Specialized Poisson queues – Steady-State measures of Performance – Single Server Models – Multiple-Server Models – Machine servicing models - (M/G/1): $(GD/\infty/\infty)$-Pollaczek-Khintchine (P-K) formula – Other queuing models – Queuing decision models – cost models – Aspiration Level Model.

Unit IV **(18 Hrs)**

Unconstrained problems – Necessary and Sufficient Conditions – The Newton Raphson Method – Constrained Problems – Equality Constraints – Inequality Constraints.

Unit V **(18 Hrs)**

Unconstrained algorithms – Direct Search Method – Gradient Method -Constrained algorithms – Quadratic Programming – Geometric Programming – Stochastic Programming – Linear Combinations method – SUMT Algorithm.

Text Book:

Hamdy A.Taha, "Operations Research An introduction", Prentice Hall of India Private Limited, New Delhi , Seventh edition.

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Choice Based Credit System
PG Programme – M.Sc. Mathematics – 2015-2017
Semester - IV

Major Elective – III :Microsoft Visual Basic – 15 PMAO41 **Duration : 90 Hrs**
Credits : 4

Aims and Objectives:

- To Learn the concept of GUI
- To know about various controls of IDE
- To know about Graphics, files and Active X controls

Course Outcome :

- Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
- Load, modify, and save changes made to forms and projects in the Visual Basic environment
- Write syntactically correct statements using local and global variables, sub procedures, forms, and Windows environment calls.
- Define and implement form objects including data arrays, control arrays, text boxes, message boxes, dialog boxes, labels, controls, menus, frames, picture boxes, pull-down menus, and combo boxes
- Manipulate strings using various String functions
- Identify the difference between Random Access files and Sequential files
- Use one dimensional array in your applications
- Create applications that use ADO. NET
- Identify and perform the steps necessary to convert Visual Basic programs to executable files that will run in the Windows environment.

Unit I **(18 Hrs)**

Starting a new project- The properties window- Common form properties-scale properties-color properties-making a form responsive-Typos-saving your work-Creating Stand-alone windows programs-The toolbox-creating controls-The name property- Properties of command buttons-simple event procedures for command buttons-Access keys-image controls-Text boxes-labels-navigating between controls- Message boxes-the grid- what happens when visual basic runs-the display in visual basic-ASCII representation of forms.

Unit II **(18 Hrs)**

Statements in visual basic-variables-setting properties with code-data types-working with variables-constants-Input Boxes-Displaying information on form-format function- picture boxes-rich text boxes-printer object-controlling program flow- built-in functions

Unit III **(18 Hrs)**

Writing own functions and procedures- mouse event procedures-Lists: one dimensional arrays-Arrays with more than one dimension- Using lists and arrays with functions and procedures-The new array-based string handling functions- Records(User-Defined types)- With statement- Enums

Unit IV **(18 Hrs)**

Control array- list and combo boxes-The flex grid control-Projects with multiple forms

Code modules: Global procedures and global variables- Do Events and sub main-Error trapping -Creating an object in Visual Basic- frames- Option buttons-Check boxes- scroll bars-Timers- Common Dialog boxes-Menus

Unit V **(18 Hrs)**

Fundamentals of graphics-Line and shape controls-Graphics via code-lines and boxes-circle, ellipses and pie charts-file commands-sequential files- Random access files-file system controls-using the data control- Active X controls: First steps- Testing the control- polishing the presentation of your control.

Connection to Database : Getting Connected – using DAO to build a simple database interface – Programming with ADO – Adding a Data Interface to Your Object Models – Working with the Visual Basic Report Designer.

Text Books :

1. "Visual Basic 6 from the ground up"- Gary Cornell, Tata McGraw-Hill, 1999
2. "The complete reference Visual Basic 6"- Neol Jerke -Tata McGraw-Hill, 2003"Visual Basic "– Paul sheriff, PHI, 1999

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M.Sc Mathematics -2015-2017
Semester IV

Major Elective – III : Advanced Functional Analysis – 15 PMAO42 Duration : 90 Hrs
Credits : 4

Aim and Objectives:

- To study about compact operators on normed spaces
- To know about Geometry of Hilbert spaces
- To study about bounded operators on Hilbert spaces

Course Outcome :

- Gain an insight into the compact linear maps.
- Understand the concept of Spectrum of a compact operator
- Study the characterization of approximate solutions.
- Gain knowledge of central concepts of inner product spaces
- Demonstrate the concept of orthonormal sets
- Represent the projection using Riesz representation theorems.
- Present the ideas of bounded operators and Adjoints.
- Learn about Normal, Unitary and self-adjoint operators
- Able to get idea of Compact self-Adjoint operators

Unit I **(18 Hrs)**

Compact linear maps – Spectrum of a compact operator.

Unit II **(18 Hrs)**

Fredholm alternative – Approximate solutions – Inner product spaces.

Unit III **(18 Hrs)**

Orthonormal sets – Approximation and Optimization – Projection and Riesz representation theorems.

Unit IV **(18 Hrs)**

Bounded operators and Adjoints – Normal, Unitary and self-adjoint operators.

Unit V **(18 hrs)**

Spectrum and numerical range – Compact self-Adjoint operators

Text Book:

Balmohan V Limaye , "Functional Analysis", **:** New Age International (P) Limited, Publishers , 4835/24, Ansari Road, Daryaganj, New Delhi, Revised Second edition

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M.Sc Mathematics -2015-2017
Semester IV

Major Elective – III : Advanced Statistics – 15 PMAO43 Duration: 90 Hrs
Credits : 4

Aim and Objectives:

- To introduce the concept of Statistics
- To study about Point estimation and Chi-squared tests
- To know about Distributions of certain quadratic forms

Course Outcome :

- Inculcate an insight into Confidence intervals for means and their differences.
- Understand the concept of Chi-Square tests
- Study the characterization of sufficient statistic.
- Demonstrate the concept of Fisher information and the Rao-Cramer inequality
- Present the idea of Limiting distributions of maximum likelihood estimators
- Understand the ideas of the sequential probability ratio test
- Evaluate the Noncentral χ^2 and noncentral F
- Able to get idea of a regression problem

Unit I (18 Hrs)

Point estimation - Confidence intervals for means - Confidence intervals for differences of means - Tests of statistical hypotheses - Additional comments about statistical tests – Chi-Square tests

Unit II (18 Hrs)

Measures of quality of estimators - A sufficient statistic for a parameter - Properties of a sufficient statistic - Completeness and uniquness - The exponential class of probability density functions - functions of a parameter - The case of several parameters - Minimal sufficient and ancillary statistics

Unit III (18 Hrs)

Bayesian estimation - Fisher information and the Rao-Cramer inequality - Limiting distributions of maximum likelihood estimators

Unit IV (18 Hrs)

Certain best tests - Uniformly most powerful tests - Likelihood ratio tests - The sequential probability ratio test

Unit V **(18 Hrs)**

The Distributions of certain quadratic forms - A test of the equality of several means - Noncentral χ^2 and noncentral F - Multiple comparisons - The analysis of variance – A regression problem - A test of independence

Text Book:

R.V.Hogg and A.T.Craig , "Introduction to Mathematical Statistics", Pearson Education, Asia, 2002, V Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M.Sc Mathematics -2015-2017
Semester IV

Major Elective – III : Advanced Topology – 15PMAO44 Duration : 90 Hrs
Credits : 4

Aim and Objectives:

- To introduce the concept of Paracompactness
- To study about Baire spaces

Course Outcome :

- Demonstrate an understanding of the concepts of metric spaces and topological spaces, and their role in mathematics.
- Prove basic results about operators on Hilbert the properties of bounded spaces.
- Prove basic results about completeness, compactness, connectedness and convergence
- these structures.
- Able to find various fundamental constructions in General Topology, such as the Stone-Cech compactifications.
- Gain knowledge about fundamental concepts as compactness, compactifications, paracompactness,
- connectedness and disconnectedness.
- Gain knowledge about the handling of several topological techniques.
- Able to apply Tychonoff's theorem, fundamental metrization theorems to construct several mathematical objects.
- Use ideas and methods of coverings to prove fundamental results related with metrisabilty and characterizations of Paracompactness.
- Analyse basic techniques related with coverings of topological spaces.

Unit I **(18 Hrs)**

The Stone-Cech Compactification – Local finiteness – The Nagata-Smirnov metrization theorem.

Unit II **(18 Hrs)**

Paracompactness – The Smirnov metrization theorem.

Unit III **(18 Hrs)**

Complete metric spaces – A space filling curve.

Unit IV **(18 Hrs)**

Compactness in metric spaces – Pointwise and compact convergence – Ascoli's theorem.

Unit V **(18 Hrs)**

Baire spaces – A Nowhere-differentiable function

Text Book :

James R. Munkres, "Topology" , **:** Prentice Hall of India Private Limited, New Delhi, Second Edition.

Sri Kaliswari College (Autonomous)-Sivakasi
Choice Based Credit System
PG Programme - M.Sc Mathematics -2015-2017
Semester IV

Core – XVI : Project – 15PMAJ41 **Duration : 90 Hrs**
Credits : 5

Project Viva-voce

Project work:

- Each learner can select for his/her research project in any one of the areas of Mathematics in consultation with his/her guide and the Head of the Department.
- The project report should be submitted to the Principal through the Head of the Department of Mathematics one week prior to the commencement of the summative examination. If a candidate fails to submit his/her project report on the date presented above, he/she may be permitted to submit the same 4 days prior to the date of viva-voce examination with a fine as prescribed by the college.
- Each learner shall submit 2 copies of his/her project report for valuation.
- The project report shall contain at least 25 pages excluding bibliography and appendices.
- The project report shall be valued for a total of 80 marks out of which 40 is internal mark and 40 is external mark. Out of the external mark 40, the external examiner and guide share 30 and 10 marks respectively. The sum of marks awarded by both the examiners shall be considered to be the final mark. For the pass in the project report the learner shall secure a minimum of 25 marks. If the learner fails to get the minimum pass mark in the project report he/she shall be permitted to submit his/her project report once again within a period of 6 months after the publication of the result.
- For those candidates who have passed in the evaluation of the project report there will a viva-voce examination of the above. The viva-voce carried a minimum of 20 marks and it will be conducted jointly by the guide and the external examiner. The learner should secure a minimum of 10 marks for a pass in the viva-voce examination failing which he/she would be required to reappear for the same after a month but within a period of 3 months for which he/she will have to pay a fee as prescribed by the college.
- Further for a pass in this paper as a whole, a learner should secure at least 50 marks in project report and viva-voce put together.