HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

(Re-Accredited at "A" Grade, by NAAC, Banglore)

UTHAMAPALAYAM – 625533.

DEPARTMENT OF MATHEMATICS

MASTER OF SCIENCE - MATHEMATICS

SYLLABUS

(Academic Year 2017 – 2018 Onwards)

PROGRAM SPECIFIC OUTCOMES

PSO1. Understand the basic concepts of Calculus, Trigonometry, 3d Geometry, Vector calculus, Analysis, Algebra, and Statistics

PSO2. Create, corroborate, and evaluate hypotheses, theories, and methods with adequate proof

PSO3. Solve complex problems by critical thinking and explicate a solution in real life situations

PSO4. Acquire, analyze, synthesize and interpret data to write reports by applying basic mathematical rules

PSO5. Apply mathematical skills in the field of computer to create relevant database records encapsulating multiple variables

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE (AUTONOMOUS)

UTHAMAPALAYAM

Choice Based Credit System

M.Sc., Mathematics (Semester)

Course Scheme & Scheme of Examinations

(Effective from the academic year 2017 – 2018 onwards)

Qualification : Passed B.Sc. in mathematics or any degree accepted by the academic council equivalent

Duration of the Course : M.Sc., **.,** Mathematics - Two academic years (4 – Semesters)

SUBJECTS OF STUDY :

1) Core Subjects – Mathematics.
2) Allied Subjects_ Mathematics

STRUCTURE OF THE QUESTION PAPER:

Internal : 25 marks

External : 75 marks

Total :100 marks

Question Paper: Three Parts A, B and C

Section – A (Multiple Choice, True or False)

Section - B (Either A or B)

Section – C (3 out 5 Questions)

COURSE CONTENT

Sem	Course Category	Title of the Course	Course Code	credits	Hours/ week	Marks allotted		
						Int	Ext	Total
I	Core I	Algebra- I	17PMAC11	5	6	25	75	100
	Core II	Analysis –I	17PMAC12	5	6	25	75	100
	Core III	Differential Equations	17PMAC13	4	6	25	75	100
	Core IV	Graph Theory	17PMAC14	4	6	25	75	100
	Elective I Elective II	Mechanics Automata theory and Formal language	17PMAE11 17PMAE12	4	6	25	75	100
II	Core V	Algebra –II	17PMAC21	5	6	25	75	100
	Core VI	Analysis –II	17PMAC22	5	6	25	75	100
	Core VII	Differential Geometry	17PMAC23	5	6	25	75	100
	Core VIII	Numerical Analysis	17PMAC24	4	6	25	75	100
	Elective III Elective IV	Combinatorial Mathematics Fuzzy sets and Logics	17PMAE21 17PMAE22	4	6	25	75	100
III	Core IX	Algebra- III	17PMAC31	5	6	25	75	100
	Core X	Analysis –III	17PMAC32	5	6	25	75	100
	Core XI	Topology	17PMAC33	4	6	25	75	100
	Elective V Elective VI	Statistics Advanced Topology	17PMAE31 17PMAE32	4	6	25	75	100
	NME	Mathematics for competitive Examination/Business statistics	17PMAN31	5	6	25	75	100
IV	Core XII	Complex Analysis	17PMAC41	5	6	25	75	100
	Core XIII	Number Theory	17PMAC42	5	6	25	75	100
	Core XIV	Functional Analysis	17PMAC43	4	6	25	75	100
	Core XV	Operations Research	17PMAC44	4	6	25	75	100
	Elective VII Elective VIII	Advanced functional analysis Graph theory –I	17PMAE41 17PMAE42	4	6	25	75	100

ALGEBRA-I

Programme :M.Sc.Maths **Part-Core - I**

Semester : I **Hours : 6**

Course Code : 17PMAC11 **Credits: 5**

COURSE OUTCOME:

CO1: Describes the algebraic theorems and proof techniques of groups and rings

UNIT – I

Another Counting Principle, Sylow's Theorem.

UNIT – II

Direct Products, Finite abelian groups .

UNIT – III

Ideals and Quotient Rings, More ideals and Quotient Rings, The field of Quotients of an integral domain .

UNIT – IV

Euclidean Rings, A particular Euclidean Ring .

UNIT – V

Polynomial Rings, Polynomials over the rational field, Polynomial over commutative Rings .

TEXT BOOK

Topics in Algebra by I.N. Herstein , second Edition, John Wiley and sons, 1999.

ANALYSIS-I

Programme :M.Sc.Maths **Part- Core - II**

Semester : I **Hours : 6**

Course Code : 17PMAC12 **Credits: 5**

COURSE OUTCOME:

CO1: Provides knowledge about the sequence and series of real number with convergence , limits, continuity and differentiability of real functions.

UNIT – I

Finite, Countable and Uncountable sets, Metric Spaces .

UNIT – II

Compact Sets, Perfect sets, Connected sets .

UNIT – III

Series, Series of Non-negative terms, The number e, The Roots and ratio tests Power Series, Summation by parts, Absolute convergence .

UNIT – IV

Limits of Functions, Continuous functions, continuity and connectedness, Discontinuities, monotonic Functions, Infinite Limits and limits at Infinity .

UNIT – V

The derivative of a real function, Mean Value theorems, the continuity of derivatives, L'Hospital's rule, Derivatives of Higher Order, Taylor's theorem .

TEXT BOOK

Principles of Mathematical Analysis by Walter Rudin, third edition,Mc GRAW-HILL international editions.

REFERENCE:

Analysis by Prof. V. Karunakaran

DIFFERENTIAL EQUATIONS

Programme :M.Sc.Maths **Part- Core - III**

Semester : I **Hours : 6**

Course Code : 17PMAC13 **Credits: 4**

COURSE OUTCOME:

CO1:Identify an ordinary and partial differential equations and find solutions using various methods

UNIT – I

Introduction, Initial Value problems for the homogeneous equation, solutions of the homogeneous equation, Wronskian and linear independence, Reduction of the order of a homogeneous equation, The Non - Homogeneous equation ,homogeneous equation with analytic coefficients, The Legendre equation.

UNIT – II

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 equations (continued) .

UNIT –III

Introduction, Equations with variable separated, Exact equations, the method of successive approximations, the Lipchitz condition, convergence of the successive approximations, non-local existence of solutions, approximations to and uniqueness of solutions .

UNIT – IV

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

Nonlinear partial differential equations of first- order- Cauchy's method of characteristics- Compatible system of First- order equations- Charpit's method-Special types of first –order equations .

TEXT BOOK:

1. An introduction to ordinary differential equations by E.A. Coddington
2. Elements of Partial Differential equations by I.N.Sneddon

GRAPH THEORY

Programme :M.Sc.Maths **Part- Core - IV**

Semester : I **Hours : 6**

Course Code : 17PMAC14 **Credits: 4**

COURSE OUTCOME:

CO1:Deals with fundamental concepts in graph theory with some of its modern applications.

UNIT – I

Graphs and simple graphs, Graph isomorphism, The incidence and adjacency matrices, sub graphs, vertex degrees, paths and connection, Cycles, The Shortest path problem, Sperner's lemma.

UNIT – II

Trees, Cut edges and Bonds, Cut vertices, Cayley's formula, The Connecter Problem, Connectivity, Blocks, Construction of Reliable Communication Networks.

UNIT – III

Euler tours, Hamiltonian cycles ,The Chinese postman problem, The travelling salesman problem

UNIT-IV

Matchings, Matchings and coverings in bipartite graphs, Perfect matching, The personnel assignment problem, The optimal assignment problem .

UNIT-V

Edge Chromatic number, Vizing's theorem, The time tabling problem.

Text Book:

Graph Theory with Applications, J.A.Bondy and U.S.R.Murty

MECHANICS

Programme :M.Sc.Maths **Part- Elective-I**
Semester : I **Hours : 6**

Course Code : 17PMAE11 **Credits: 4**

COURSE OUTCOME:

CO1: Demonstrate knowledge and understanding of the dynamics of system of particles , motion of rigid body, lagrangian and Hamiltonian formulation of classical mechanics

UNIT – I

Mechanics of a particle, Mechanics of a system of particles, Constraints .

UNIT – II

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

Derivation of Lagrange's equation from Hamilton's principle, Extension of Hamilton's principle to nonholonomic systems, Conservation theorems and symmetry properties. .

UNIT – IV

Reduction to the equivalent one-body problem, The equations of motion and first integrals, The Virial theorem .

UNIT – V

The Differential equation for the orbit and integral power – law potentials, conditions for closed orbits (Bertrand's theorem) The Kepler problem Inverse square law of force, the motion in time in the Kepler problem, the Laplace – Rungelenz vector.

TEXT BOOK:

Classical Mechanics by H. Goldstein, second Edition, Addison Wesley New York ,1980.

AUTOMATA THEORY AND FORMAL LANGUAGE

Programme :M.Sc.Maths **Part- Elective-II**
Semester : I **Hours : 6**
Course Code : 17PMAE12 **Credits: 4**

COURSE OUTCOME:

CO1: Introduce concepts in automata theory and theory of computation. Identify different formal language , classes and their relationship. Determine the decidability and intractability of computational problems.

Unit I:

Why study automata theory? Introduction to formal proof, Additional forms of proof, Inductive proofs, The central concepts of Automata theory .

Unit II:

An informal picture of finite automata, Deterministic finite automata, Non-deterministic finite automata, An application: Text search, Finite automata with epsilon transitions

Unit III:

Regular expressions, Finite automata and regular expressions, Applications of regular expressions, Algebraic laws of regular expressions

Unit IV:

Proving languages are not regular, Closure properties of regular languages, Decision properties of regular languages, Equivalence and Minimization of automata

Unit V:

Context-free grammars, Parse trees, Applications of context-free grammar, Ambiguity in grammars and languages, Definition of Push Down Automata, Languages of PDA, Equivalence of PDA's and CFG's, Deterministic PDA

TEXT BOOK:

Introduction to Automata, Languages, and Computation, II Edition by J.E. Hoperoft, R.Motwani, and J.D. Ullman, Pearson Edition, 2001

ALGEBRA II

Programme :M.Sc.Maths **Part- Core - V**
Semester : II **Hours : 6**

Course Code : 17PMAC21 **Credits: 5**

COURSE OUTCOME:

CO1: Learn to solve system of linear equations and recognize the concept of vector spaces, matrix algebra and linear transformations

UNIT – I

Dual spaces, Inner product spaces .

UNIT – II

Modules, the algebra of linear transformation, characteristic roots, matrices.

UNIT – III

Canonical forms, Triangular form, Nilpotent transformations, A decomposition of V: Jordan form.

UNIT – IV

Canonical forms, Rational canonical form, Trace and Transpose.

UNIT – V

Determinants, Hermitian, Unitary and Normal Transformations .

TEXT BOOK:

Topics in Algebra by I.N. Herstein (2^{nd} Edition) John Wiley and sons, 1999.

ANALYSIS II

Programme :M.Sc.Maths **Part-Core - VI**

Semester : II **Hours : 6**

Course Code : 17PMAC22 **Credits: 5**

COURSE OUTCOME:

CO1: Demonstrate capacity for mathematical reasoning, proving and explaining concept from real analysis

UNIT – I

Definitions and existence of the Integral, Properties of the Integral, Integration and Differentiation, Integration of vector valued functions. Rectifiable curves.

UNIT – II

Discussion of the main Problem, Uniform convergence and continuity, uniform convergence and integration, Uniform convergence and differentiation, equicontinuous families of functions, The Stone – Weierstrass theorem .

UNIT – III

Power series, the exponential and logarithmic functions, the trigonometric functions, the algebraic completeness of the complex field, Fourier series, the gamma function .

UNIT – IV

Linear transformation – Differentiation – The contraction principle – the inverse function theorem.

UNIT – V

The implicit function theorem – the rank theorem – determinants – derivatives of higher order – differentiation of integrals .

TEXT BOOK:

Principles of Mathematical Analysis by Walter Rudin, Third Edition McGraw Hill.

DIFFERENTIAL GEOMETRY

Programme :M.Sc.Maths **Part-Core - VII**

Semester : II **Hours : 6**

Course Code : 17PMAC23 **Credits: 5**

COURSE OUTCOME:

CO1: Focuses on the concepts of differential geometry and its applications in modern mathematics.

UNIT – I

Introductory remarks about space curves, Definition, Arc Length, Tangent, normal and binomial curvature and torsion of a curve given as the intersection of two surfaces, contact between curves and surfaces, Tangent surfaces, involutes and evolutes .

UNIT – II

Intrinsic equations, fundamental existance theorem for space curves, Helices and definition of a surface, curves on a surface, surfaces of revolution, Helicoids .

UNIT – III

Metric, Direction coefficients, Families of curves, Isometric correspondence, Intrinsic properties, Geodesics, canonical geodesic equations, Normal Property of geodesics .

UNIT – IV

Geodesics curvature, Gauss – Bonnet theorem, Gaussian curvature, Surfaces of constant curvature .

UNIT – V

The second fundamental form, Principal curvatures, lines of curvature, developables, Developables associated with space curves Developable associated with curves on surfaces, Minimal surfaces, Ruled surfaces. .

TEXT BOOK:

An Introduction to Differential Geometry by T.G.Willmore, Oxford University press.

NUMERICAL ANALYSIS

Programme :M.Sc.Maths **Part-Core - VIII**

Semester : II **Hours : 6**

Course Code : 17PMAC24 **Credits: 4**

COURSE OUTCOME:

CO1: Understand the numerical algorithm and skills to implement the concept to solve mathematical problem

UNIT – I

Introduction, Bisection Method, iteration method, based on first degree equation, iteration methods based on second degree equation, rate of convergence, General Iteration Methods.

UNIT – II

Introduction, Direct Methods, Iteration methods, Eigen values and eigen vectors.

UNIT – III

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

UNIT – IV

Introduction, Numerical differentiation. Extrapolation methods, partial differentiation, Numerical integration, Methods based on interpolation.

. **UNIT – V**

Introduction, Difference equation, Numerical methods, single step methods.

TEXT BOOK:

Numerical methods for scientific and Engineering computation M.K. Jain, S.R.K. Iyengar and R.K. Jain, Fourth Edition; New Age International Publishers, 2003.

COMBINATORIAL MATHEMATICS

Programme :M.Sc.Maths **Part- Elective-III**

Semester : II **Hours : 6**

Course Code : 17PMAE21 **Credits: 4**

COURSE OUTCOME:

CO1: Provides the counting strategy to solve and analyse problems involving the combinations, distributions and combinatorial identities

UNIT – I

Introduction – the rules of sum and product – permutations – combinations – distribution of distinct objects – distributions of non – distinct objects .

UNIT – II

Introduction – Generating functions for combinations – Enumerators for permutation – distributions of distinct objects into non – distinct cells – partitions of integer – elementary relations..

UNIT – III

Introduction – Linear recurrence relations with constant coefficients – solution by the technique of generating functions – recurrence relations with two indices .

UNIT – IV

Introduction – The principle of inclusion and exclusion – the general formula – derangements .

UNIT – V

Introduction – Equivalence classes under permutation group – equivalence classes of functions – weight and inventories of functions –Polya's fundamental theorem – generalizations of Polya's theorem .

TEXT BOOK:

Introduction to combinatorial Mathematics by C.T. Liu, McGraw Hill, 1968.

FUZZY SETS AND LOGICS

Programme :M.Sc.Maths **Part- Elective-IV**

Semester : II **Hours : 6**

Course Code : 17PMAE22 **Credits: 4**

COURSE OUTCOME:

CO1: Provide an emphasis on the differences and similarities between fuzzy sets and classical set theories provide a brief introduction to fuzzy arithmetic concepts.

UNIT I:

Fuzzy sets – Basic types – Fuzzy sets – Basic concepts – Additional properties of α-cuts – Representation of fuzzy sets.

UNIT II:

Extension principle for fuzzy sets – Types of Operations – Fuzzy Complements – Fuzzy numbers.

UNIT III:

Linguistic variables – arithmetic operations on intervals – arithmetic operations on fuzzy numbers.

UNIT IV:

Fuzzy relation – Crisp versus fuzzy relations – projection and cylinderic extensions – Binary fuzzy relations on a single set – Fuzzy equivalence relations.

UNIT V:

Fuzzy logic – Classical logic-An overview – multivalued logic – Fuzzy propositions – Fuzzy quantifiers – Linguistic Hedges – Inference from conditional fuzzy propositions.

TEXT BOOK:

Fuzzy sets and Fuzzy logic – Theory and applications, by George J.Klir and B.Yuan

ALGEBRA III

Programme :M.Sc.Maths **Part- Core - IX**

Semester : III **Hours : 6**

Course Code : 17PMAC31 **Credits: 5**

COURSE OUTCOME:

CO1: Focuses on galois groups and to apply the groups theoretic information to deduce results about fields and polynomials.

UNIT – I

Extension fields, the transcendence of e .

UNIT – II

Roots of polynomials, construction with straightedge and compass, more about roots .

UNIT – III

The elements of Galois theory, solvability by Radicals.

UNIT – IV

Galois group over the rationals, finite fields .

UNIT – V

Wedderburn's theorem on finite division rings .

TEXT BOOK:

Topics in Algebra by I.N. Herstein, Second Edition, John Wiley and sons, 1999

ANALYSIS III

Programme :M.Sc.Maths **Part-Core - X**

Semester : III **Hours : 6**

Course Code : 17PMAC32 **Credits: 5**

COURSE OUTCOME:

CO1: Understand the fundamentals of measure theory and theorems underlying the theory of integration

UNIT – I

Lebesgue outer measure – Measurable sets – Regularity.

UNIT – II

Measurable functions – Borel and Lebesgue measurability.

UNIT – III

Integration of non – negative functions – the general integral – integration of series.

UNIT – IV

Riemann and Lebesgue integrals – the four derivatives – continuous non – differentiable functions.

UNIT – V

Functions of bounded variations – Lebesgue differentiation theorem – differentiation and integration – the Lebesgue set.

TEXT BOOK:

Measure Theory and Integration – G.de Barra, Willey Eastern Ltd. (2^{nd} Edition)

TOPOLOGY

Programme :M.Sc.Maths **Part- Core – X1**

Semester : III **Hours : 6**

Course Code : 17PMAC33 **Credits: 4**

COURSE OUTCOME:

CO1: The study of geometrical properties and spatial relations unaffected by the continuous change of shape and size of figures

UNIT – I

Topological spaces – Basis for a topology – the order topology – the product topology on XxY. The sub space topology – closed sets and limit Points – continuous functions – the product topology.

UNIT – II

The Metric topology – connected spaces – connected spaces on a real line. .

UNIT – III

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

UNIT – IV

Countability axioms – the separation axioms – normal spaces.

UNIT – V

The Urysohn Lemma – the Urysohn Metrization theorem – Tietze extension theorem – The Tychonoff theorem.

TEXT BOOK:

Topology (2^{nd} Edition) James R. Munkres, Prentice – Hall of India Private Ltd., New Delhi.

STATISTICS

Programme :M.Sc.Maths **Part- Elective-V**

Semester : III **Hours : 6**

Course Code : 17PMAE31 **Credits: 4**

COURSE OUTCOME:

CO1: Formulate and analyse the mathematical statistics and problems

UNIT – I

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

Distributions of two random variables, conditional distributions and expectations. The correlation co-efficient, Independent random variables. Extension to several random variables..

UNIT – III

The binomial and related distributions, the Poisson distribution, the Gamma and Chi-square distributions, the normal distributions, the Bivariate normal distributions.

UNIT – IV

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, the moment generating function technique, distributions of order statistics.

UNIT – V

Convergence of distribution, convergence of probability, limiting moment generating functions, the central limit theorem, some theorems of limiting distributions.

TEXT BOOK: Introduction to Mathematical statistics, 5^{th} Edition by R.V. Hogg and A.T. Craig, Pearson Education, Asia 2002.

ADVANCED TOPOLOGY

Programme :M.Sc.Maths **Part- Elective-VI**

Semester : III **Hours : 6**

Course Code : 17PMAE32 **Credits: 4**

COURSE OUTCOME:

CO1: Uses to analyze complex networks and it applies differential topology to probability to identify multivariate interactions.

UNIT – I

The stone – cech compactification – Local finiteness.

UNIT – II

The Nagata – Smirnov Metrization theorem – Para compactness – the smirnov metrization theorem.

UNIT – III

Complete Metric spaces – a space filling curve.

UNIT – IV

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

UNIT – V

Baire spaces – a nowhere differentiable functions.

TEXT BOOK:

James R. Munkres "Topology". (2^{nd} Edition)

Prentice Hall of India Private Ltd.,

MATHEMATICS FOR COMPETITIVE EXAMINATIONS

Programme :M.Sc.Maths **Part- NME**

Semester : III **Hours : 6**

Course Code : 17PMAN31 **Credits: 5**

COURSE OUTCOME:

CO1: Focuses on the problems related to competitive exams

Unit-I

H.C.F. and L.C.M of numbers – decimal – fractions – simplifications – average – problems on numbers – problems on ages.

Unit-II

Percentage – profit and loss- ratio and proportion partnership – simple interest and compound interest.

Unit-III

Time and work – Time and distance – problems on trains – Allegation of mixture.

Unit – IV

Calendar –clocks –odd man out and series.

Unit-V

Verbal and non-verbal reasoning.

TEXT BOOK:

1.Quantitative Aptitude, by R.S.Agarwal,Publishers: S.Chand and Co.1990

2.Verbal and non-verbal reasoning**,** by A.S.Agarwal, Publishers:S.Chand and Com.,1994

BUSINESS STATISTICS

Programme :M.Sc.Maths **Part : NME**

Semester : III **Hours : 6**

Course Code : 17PMAN32 **Credits: 5**

COURSE OUTCOME:

CO1: Describe data and make evidence based decisions using inferential statistics and to make inferences about the population from sample data.

Unit I:

Measures of central tendency – Definition – Mean – Median – Mode – Their merits and demerits – Weighted Arithmetic mean .

Unit II:

Measures of dispersion and skewness – Range – Quartile deviation – Standard deviation – Coefficient of variation – Pearsons and Bowley Coefficient of skewness.

Unit III:

Scatter diagram – Pearson's Coefficient of correlation – Rank correlation.

Unit IV:

Index numbers – Meaning and uses – Methods of construction – Laspeyer's method – Paasche method – Fisher's Ideal Index – Marshall Edgeworth method – Kelley's method

Unit V:

Analysis if time series – Estimation of trend – Methods of least squares (Straight line only) – Free hand curve (Chapter 13: Pages 522-588).

Text Book:

Elements Statistical Methods, by S.P. Gupta, Publishers: Sultan Chand & Sons, 16th Edition (2005).

COMPLEX ANALYSIS

Programme :M.Sc.Maths **Part- Core – XII**

Semester : IV **Hours : 6**

Course Code : 17PMAC41 **Credits: 5**

COURSE OUTCOME:

CO1: Understand the fundamental concepts of complex analysis such as analytic functions, complex integration

UNIT – I

The Algebra of complex numbers. The Geometric representation of complex numbers.

UNIT – II

Introduction to the concept of Analytic function, Elementary theory of Power series, the exponential and Trigonometric functions. .

UNIT – III

Elementary point set Topology – conformality, Linear transformations, elementary conformal mappings .

UNIT – IV

Fundamental theorems, Cauchy's integral formula. Local properties of analytical functions .

UNIT – V

The general form of Cauchy's theorem. The Calculus of residues, Harmonic functions, Power series expansions.

TEXT BOOK:

Complex Analysis by L.V. Ahlfors (3rd Edition) McGraw Hill ISE, 1981

NUMBER THEORY

Programme :M.Sc.Maths **Part- Core - XIII**

Semester : IV **Hours : 6**

Course Code : 17PMAC42 **Credits: 5**

COURSE OUTCOME:

CO1: Knowledge in the theory of integer from the list of axioms and explore some research problem in number theory

UNIT – I

Introduction, divisibility, Greatest Common divisor, prime numbers, the fundamental theorem of arithmetic. The series of reciprocals of the primes. The Euclidean algorithm, the GCD of more than two numbers, the Mobius function, the Euler totient function, a relation connecting μ and ϕ , A product formula for $\phi(n)$. The Dirichlet product of arithmetical functions, Dirichlet inverses and the Mobius inversion formula, the Mangoldt function, Multiplicative functions, multiplicative functions and Dirichlet multiplication.

UNIT – II

Liouville's functions, the divisor function. The Bell series of an arithmetical function generalized convolutions, Formal Power series. The bell series and Dirichlet multiplication. Derivatives of arithmetic function. The selberg identity, big oh notation, Asymptotic equality of functions Euler's summation formula, some elementary asymptotic formulas. The average order of d(n), the average order of the divisior functions $\sigma_\alpha(n)$, the average order of $\phi(n)$. An application to the distribution of lattice points visible from the origin, the average order of $\sigma_\alpha(n)$ and $\Lambda(n)$, the partial sums of a Dirichlet product. Application to $\mu(n)$ and $\Lambda(n)$, another identity for the partial sums of a Dirichlet product.

UNIT – III

Introduction to Chebyshev's function -Definition , basic properties of congruences, residue classes and complete residue system, Linear congruences, reduced residue system and the Euler – Fermat theorem. Ploynomial congruences modulo p, Lagrange's theorem, application of Lagrange's theorem

UNIT – IV

Simultaneous linear congruences. The Chinese remainder theorem. Applications of Chinese remainder theorem. Polynomial congruences with prime power moduli. The principle of cross classification. A decomposition property of reduced residue systems, Quadratic residuces, Legendre's symbol and its properties, Evaluation of (-1/p) and (2/p) Gauss Lemma .

UNIT – V

The quadratic reciprocity Law, application of the quadratic reciprocity law, the Jacobi Symbol. Gauss Lemma and the quadratic reciprocity law. The reciprocity law for quadratic Gauss sums.

TEXT BOOK:

Introduction to Analytic Number Theory by T.M. Apostol.

REFERENCE BOOK;

Introduction to the theory of Numbers by Niven and Zuckerman.

FUNCTIONAL ANALYSIS

Programme :M.Sc.Maths **Part-Core - XIV**

Semester : IV **Hours : 6**

Course Code : 17PMAC43 **Credits: 4**

COURSE OUTCOME:

CO1: Deals with the duality in Banach Spaces, Hilbert spaces and spectral theory for compact operators will be described.

UNIT – I:

Banach spaces : Definition and examples – Continuous Linear transformations - The Hahn Banach theorem.

UNIT – II:

The Natural Imbedding of N in N** - The open mapping theorem – The Conjugate of an operator .

UNIT – III:

Hilbert Spaces : The definition and some simple properties – Orthogonal complements – Orthonormal sets – The conjugate space H*.

UNIT –I V:

The adjoint of an operator – Self adjoint operators – Normal and Unitary operators – Projections.

UNIT – V:

Finite Dimensional Spectral Theory -Matrices – Determinants and the spectrum of an operator – The spectral theorem .

TEXT BOOK:

Introduction to Topology and Modern Analysis by G.F.Simmons Tata McGraw - Hill (2004)

OPERATIONS RESEARCH

Programme :M.Sc.Maths **Part-Core - XV**

Semester : IV **Hours : 6**

Course Code : 17PMAC44 **Credits: 4**

COURSE OUTCOME:

CO1: The central objective of Operation research is optimisation (i.e) to do the best things under the given circumstances

UNIT – I

Scope of network applications, network definitions, minimal spanning tree algorithm, shortest route Problem, Maximal flow model, minimum cost capacitated flow problem CPM and PERT .

UNIT – II

Why study Queues? Elements of queueing models. Role of exponential distribution, pure birth and death models, relationship between exponential and Poisson distributions, Generalized Poisson queueing model .

UNIT – III

Specialized Poisson queues, (M/M/1) Pollaczek – khintchine (P.K) formula, other queueing models, queueing decision models .

UNIT – IV

Introduction, unconstrained problems, constrained problems.

UNIT – V

Unconstrained non-linear algorithms, constrained algorithms.

TEXT BOOK:

Operation Research– An introduction,VI Edition, by H.A.Taha, prentice– Hall of India – Pvt Ltd-1997.

ADVANCED FUNCTIONAL ANALYSIS

Programme :M.Sc.Maths **Part- Elective-VII**

Semester : IV **Hours : 6**

Course Code : 17PMAE41 **Credits: 4**

COURSE OUTCOME:

CO1: Demonstrate capacity for mathematical reasoning through analysing , proving the concept from functional analysis

UNIT I:

Compact linear maps-Spectrum of a compact operators.

UNIT II:

Inner product spaces-Ortho normal sets-Projections and Riesz Representation theorem.

UNIT III:

Bounded operators and adjoints-normal,unitary and self adjoint operators,spectrum and numerical range.

UNIT IV:

The definitions and some examples of Regular and singular elements-Topological divisors of zero-The spectrum-The formula for the spectral radius.

UNIT V:

The Gelfand mapping- Applications of the formula $r(x) = \lim \left\| x^n \right\|^{1/n}$ -Involution in Banach Algebras-The Gelfand Neumark Theorem.

TEXT BOOK:

1.Functional Analysis , by B.V.Limaye (Unit I –III)
2.Introduction to Topology and Modern Analysis by G.F.Simmons(unit IV, V)

GRAPH THEORY I

Programme :M.Sc.Maths **Part- Elective-VIII**

Semester : IV **Hours : 6**

Course Code : 17PMAE42 **Credits: 4**

COURSE OUTCOME:

CO1: To understand and apply the fundamental concepts in graph theory. To apply graph theory based tools in solving practical problems. To improve the proof writing skills.

Unit I:

Independent sets, Ramsey's theorem, Turan's theorem, Schur's theorem, A Geometry problem .

Unit II:

Chromatic number, Brook's theorem, Hajo's conjecture, Chromatic polynomials, Girth and Chromatic number, A storage problem.

Unit III:

Plane and Planar graphs, Dual Graphs, Euler's formula, Bridges, Kuratowski's theorem, The five-color theorem and Four color conjecture, Non Hamiltonian Planar graphs, A planarity Algorithm .

Unit IV:

Directed Graphs, Directed paths, Directed cycles, A job sequencing problem, Designing an efficient computer drum, Making a road system one way, Ranking the participants in a tournament .

Unit V:

Network, Flows, Cuts, The Max-Flow, Min-cut theorem, Menger's theorem, Feasible flows, Circulation and potential differences, The number of spanning trees, perfect squares .

TEXT BOOK:

Graph Theory with Applications, J.A. Bondy and U.S.R Murty