KANCHI MAMUNIVAR CENTRE FOR POSTGRADUATE STUDIES

(Autonomous – Reaccredited with "B++" Grade by NAAC)

(A College with potential for Excellence)

LAWSPET, PUDUCHERRY - 605008

M.Sc. – MATHEMATICS

(Effect From 2019 - 2020 batch)

KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDIES

(Autonomous)

(A College with Potential for Excellence – Reaccredited with "B++" Grade by NAAC)

Puducherry 605 008

Department of Mathematics

M.Sc. MATHEMATICS (CBCS)

SEM	CODE	TITLE OF THE PAPER	CREDIT	THEORY HOURS	SEMINAR / Assignment/ Test	TUTORIAL/ CSIR-NET COACHING
I	MAHT-101	Real analysis	4	4	1+1	2 hours per week
	MAHT-102	Linear Algebra	4	4	1+1	
	MAHT-103	Ordinary Differential Equations	4	4	1+1	
	MASC-104	Soft core – I offered by the Dept.	3	3	1+1	
	MASC-105	Soft core – II offered by other Dept.	3	3	1+1	
II	MAHT-206	Advanced algebra	4	4	1+1	2 hours per week
	MAHT-207	Complex Analysis	4	4	1+1	
	MAHT-208	Statistical Inference	4	4	1+1	
	MASC-209	Soft core – III offered by the Dept.	3	3	1+1	
	MASC-210	Soft core – IV offered by the Dept.	3	3	1+1	
III	MATH-INT	INTERNSHIP/MINI PROJECT	3	-	-	2 WEEKS
	MAHT-311	Topology	4	4	1+1	2 hours per week
	MAHT-312	Partial Differential Equations	4	4	1+1	
	MAHT-313	Classical Dynamics	4	4	1+1	
	MASC-314	Soft core – V offered by the Dept.	3	3	1+1	
	MASC-315	Soft core - VI offered by the Dept.	3	3	1+1	
IV	MAHT-416	Measure theory	4	4	1+1	2 hours per week
	MAHT-417	Functional Analysis	4	4	1+1	
	MAHT-418	Operations Research	4	4	1+1	
	MASC-419	Soft core – VII offered by the Dept.	3	3	1+1	
	MASC-420	Soft core – VIII offered by other Dept.	3	3	1+1	

Credits for 12 Hard core papers = 12*4 =48 credits
Credits for 8 soft core papers = 8 * 3 =24 credits
Internship/mini Project = 3 credits
Total Credits = 75

LIST OF HARDCORE PAPERS

SLNO	SUBJECT CODE	TITLE OF THE PAPER
1	MAHT101	Real analysis
2	MAHT102	Linear Algebra
3	MAHT103	Ordinary Differential Equations
4	MAHT206	Advanced Algebra
5	MAHT207	Complex Analysis
6	MAHT208	Statistical Inference
7	MAHT311	Topology
8	MAHT312	Partial Differential Equations
9	MAHT313	Classical Dynamics
10	MAHT416	Measure theory
11	MAHT417	Functional Analysis
12	MAHT418	Operations Research

LIST OF SOFT CORE PAPERS

SLNO	TITLE OF THE PAPER
1	Discrete Mathematics
2	Network and Queueing theory
3	Integral Transforms
4	Introduction to Fuzzy sets and its applications
5	Numerical Methods
6	Fluid Dynamics
7	Probability Theory
8	Calculus of Variations
9	Number Theory
10	Scilab
11	Difference equations and z-transform
12	Graph Theory
13	Stochastic Processes
14	Automata Theory
15	Differential Geometry
16	General Mathematics (other department)

QUESTION PATTERN FOR M.SC MATHEMATICS

Each paper will have 100 marks with CIA(40 marks) and End semester examination(60 marks)

CIA

The CIA component of 40 marks shall have the following split-up

Best 2 tests out of 3 tests	15 marks
Mid-Semester examination	15 marks
Seminar/Assignment	10 Marks

External examination

Question Paper Pattern

Part A consists of 10 questions and each question carries 1 mark

Choose not less than two questions from each unit. (10x1 = 10)

Part B consists of 5 Questions of internal choice type (5X4=20)

Choose questions compulsorily from each unit.

Part C consists of 5 questions and answers any three (3X10=30).

Choose Five questions from four units. Do not omit any unit.

INTERNSHIP/MINI PROJECT

a) Report submission and evaluation 60 marks
b) Viva – voce examination 40 marks

Total : 100 marks

KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDIES
(Autonomous) PUDUCHERRY-605008.
DEPARTMENT OF MATHEMATICS
M.Sc. MATHEMATICS (CBCS)
(From 2019-20 Batch Onwards)
SCHEME OF EXAMINATIONS

SEM	CODE	TITLE OF THE PAPER	Duration of the examination	Marks		
			Hours	IA	UM	TOTAL
I	MAHT-101	Real analysis	3	40	60	100
	MAHT-102	Linear Algebra	3	40	60	100
	MAHT-103	Ordinary Differential	3	40	60	100
	MASC-104	Soft core – I offered by the Dept.	3	40	60	100
	MASC-105	Soft core – II offered by other Dept.	3	40	60	100
II	MAHT-206	Advanced algebra	3	40	60	100
	MAHT-207	Complex Analysis	3	40	60	100
	MAHT-208	Statistical Inference	3	40	60	100
	MASC-209	Soft core – III offered by the Dept.	3	40	60	100
	MASC-210	Soft core – IV offered by the Dept.	3	40	60	100
III	MATH-INT	INTERNSHIP/MINI PROJECT	Report submission and evaluation 60 External Viva-voce 40			100
	MAHT-311	Topology	3	40	60	100
	MAHT-312	Partial Differential Equations	3	40	60	100
	MAHT-313	Classical Dynamics	3	40	60	100
	MASC-314	Soft core – V offered by the Dept.	3	40	60	100
	MASC-315	Soft core - VI offered by the Dept.	3	40	60	100
IV	MAHT-416	Measure theory	3	40	60	100
	MAHT-417	Functional Analysis	3	40	60	100
	MAHT-418	Operations Research	3	40	60	100
	MASC-419	Soft core – VII offered by the Dept.	3	40	60	100
	MASC-420	Soft core – VIII offered by other Dept.	3	40	60	100

MAHT-101: REAL ANALYSIS

Unit I : Continuity

Limits of Functions-Continuous Functions- Continuity and compactness-continuity and connectedness – Discontinuities- Monotonic functions.

Unit II : The Riemann Stieltjes Integral

Definition and existence of the integral- properties of the integral – Integration and Differentiation – Integration of vector valued functions.

Unit III : Sequences and Series of functions

Discussion of main problem – Uniform convergence – uniform convergence and continuity - uniform convergence and Integration - uniform convergence and Differentiation.

UNIT IV :Functions of several variables

Differentiation – Contraction principle – inverse Function theorem – Implicit Function theorem.

TEXT BOOK

Treatment as in Principles of Mathematical Analysis by Walter Rudin.

SECTIONS

4.1 - 4.6, 6.1- 6.4, 7.1-7.5, 9.2-9.5.

REFERENCE BOOKS

1. Walter Rudin – Principles of Mathematical Analysis – Mc-Graw Hill International Edition, III edition.
2. Charles Chapman Pugh – Real Mathematical Analysis – Spinger.
3. Patrick M. Fitz Patrick – Advanced Calculus – AMS Pine and Applied undergraduate text – Indian edition,2006.
4. N.L Carothers – Real Analysis – Cambridge University Press.
5. Tom M Apostal -Treatment as in Mathematical Analysis

MAHT-102: LINEAR ALGEBRA

Unit I :Algebra of linear transformation

Algebra of linear transformation – regular and singular linear transformation – Range of a Linear Transformation - rank of a linear transformation -Idempotent - – nilpotent - characteristic roots and characteristic vectors of a linear transformation.

Unit II :Canonical Forms

Matrix of a linear transformation – Canonical form – Similar linear transformations – invariant under linear transformation - Triangular form - Nilpotent transformation – index of nilpotence – cyclic with respect to linear transformation

Unit III: Types of linear transformation

Trace and Transpose of a matrix and linear transformation- Transpose of matrix – symmetric matrix – skew- symmetric matrix – adjoint – Hermitian – skew- Hermitian - Theory of determinants – Cramer's rule

Unit IV: Speciallinear transformation

Hermitian, Unitary and Normal transformations – real quadratic form

TEXT BOOK

Topics in Algebra by I.N.Herstein , Second Edition Wiley Eastern Ltd.

SECTIONS 6.1 – 6.5, 6.8-6.11.

REFERENCE BOOKS

1. Michael Artin – Agebra – Prentice Hall of India Pvt. Ltd – Edn. 1991.
2. A Ramachandra Rao and P. Bhimasankaran – Linear Algebra – Tata McGraw Hill publishing company Ltd, New Delhi – Edn 1992.
3. Klaus Janich – Linear Algebra – Springer International Edition – Edn. 1994.
4. Gilbert Strang – Linear Algebra and its applications – Cenjage Learning India Pvt. Ltd. – Edn 2006.
5. SiymourLipschutz and Marc Lipson – Linear Algebra - Tata MC Graw Hill Education Private Ltd. – Edn 2001.
6. Kenneth Hoffman and Ray Hunze – Linear Algebra – Prentice Hall of India – II edition – 2002.

MAHT-103: ORDINARY DIFFERENTIAL EQUATIONS

Unit I : Boundary Value problems

Boundary Value problems and Characteristic function Representations – Initial Value and Boundary Value Problem – Sturm-Liouville Problem. Orthonormal Function – Proper Sturm-Liouville Problems and properties - Characteristic numbers – Orthogonality of Characteristic functions – Expansion of arbitrary functions in a series of orthogonal functions.

Unit II : Power Series Solution

Series solution of first order equations – Second order linear equations – Ordinary points – Regular singular points – Gauss's Hyper-geometric equation.

Unit III : Legendre and Bessel

Legendre polynomials – Properties of Legendre polynomials – Bessel functions – Properties of Bessel's function .

Unit IV : System of First order equations and Non-linear equations

Linear system-homogenous linear systems with constant coefficients - Autonomous systems – The phase plane and its phenomena – Types of critical points – Stability – Critical points and stability for linear systems.

TEXT BOOK

1. **Francis B.Hilderbrand – Advanced calculus for applications – Prentice Hall Inc – Edn 1962**
2. **George F. Simmons - Differential equations with application and historical notes – Mc Graw Hill International edition - Second edition.**

SECTIONS

5.1, 5.6 & 5.7 (Text book 1) &7.43

5.27 – 5.31, 8.44 – 8.47, 10.54-10.56, 11.58 – 11.60(Text book 2)

REFRENCE BOOKS

1. Richard Bronson – Differential Equations – Schaum's outline series – Mc-Graw Hill International edition - Second edition.
2. Purna Chandra Binual – Ordinary Differential Equation - Prentice Hall India learning Pvt. Ltd. – Edn 2008.

MAHT- 206: ADVANCED ALGEBRA

Unit – 1 : Extension Field and Roots of Polynomials

Extension Fields-Definition of a root of a polynomial p(x) ∈ F(x) – Remainder theorem and its consequences – The concept of splitting field of a polynomial f(x) ∈ F[x] – To set up an isomorphism between F[x] and $F'[t]$, the respective polynomial rings over F and F' from a given isomorphism of F onto F' - The isomorphism between two splitting fields of the same polynomial over a given field F.

Unit – 2 : More about roots

The concept of derivative of f(x) ∈F[x] – Rules of differentiation for sum of two polynomials , scalar multiplication of a polynomial and product of two polynomials – The equivalence between the existence of a multiple root of a function f(x) ∈ F[x] and the simultaneous vanishing of the function and its derivative at a given point and its consequences – Simple extension – Finite extensions realizable as simple extension for a field of characteristic zero.

Unit – 3 : Galois Theory

Automorphism of a field K – Fixed field of the group of automorphisms of K – Definition of G(K,F) – Bound on the size of G(K,F) – Symmetric rational functions – Normal extension – The relationship between splitting fields and normal extension – Galois group of f(x) ∈ F[x] – Fundamental theorem of Galois theory.

Unit – 4 :Wedderburn's theorem

Wedderburn's theorem on division rings (First proof only) – Definition of adjoint of an element in Q, the division ring of real quaternions – N(x), the norm of x in Q – Lagrange identity – Hurwitz ring of integral quaternions – Left division algorithm – Lagrange's form – Square theorem.

TEXT BOOK
Topics in Algebra BY I.N. Herstein, 2nd edition Wiley Eastern Ltd., 1999.

SECTIONS: 5.1,5.3, 5.5, 5.6, 7.2 and 7.4

REFERENCE BOOKS

1. Michael Antony – Algebra – Prentice hall of India Pvt. Ltd.- Edition 1991.

2. John B. Fraleigh – First course in Abstract Algebra – Addisionwiesley – 5th edition, 1999.

3. Peter J. Cameron – Introduction to Algebra – Oxford science publications – Edition 1998.

4. Joseph A. Gallian – Contemporary Abstract Algebra – Narosa publishing house – 4th edition, 1999.

5. P.B. Battacharya, S.K. Jain and S.R. Nagpaul – Basic Abstract Algebra – Cambridge university press , 2nd edition, 1997.

MAHT-207: COMPLEX ANALYSIS

Unit I :Conformality and Linear transformation

Area and closed curves-analytic functions in regions-conformal mapping-length and area- linear group- cross ratio- symmetry- oriented circles-families of circles
Harmonic Functions: Definition and Basic Properties – The Mean Value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle.

Unit 2 :Harmonic Functions

Definition and Basic Properties – The Mean Value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle.

Unit – 3 : Infinite Products

Infinite products – Convergence of infinite products – A necessary and sufficient condition for the absolute convergence of the product $\prod_1^{\infty}(1 + a_n)$ - Canonical products – Weierstrass theorem for infinite product – The Gamma functions – Legendre's duplication formula – Entire functions – Jensen's formula – The Genus and order of an entire functions – Hadamard's theorem.

Unit – 4 :Weierstrass theory

Simple periodic function – doubly periodic function-The Weierstrass theory – The Weierstrass p-function – The function $\zeta(z)$ and σ(z) – Legendre's relation – The Laurent expansion of $\zeta(z)$ - The first order differential equation for p(z).

TEXT BOOK:

Complex Analysis by Lars V. Ahlfors , McGraw Hill Company , Third edition

SECTIONS:

Chapter 3: sections 2.1 – 2.4, 3.1-3.5
Chapter 4: sections 6.1-6.5
Chapter 5: sections 2.1-2.5,3.1-3.2
Chapter 7: sections 1.1-1.3,2.1-2.4,3.1-3.3

REFERENCE BOOK:

1. John B Conway – Functions of one complex variable – Springer International student edition (II edition).
2. Ponnusamy – Foundations of Complex Analysis – Narosa Publications,1995.
3. Ponnusamy and Silverman- Complex Variable with application-Narosa

MAHT- 208 STATISTICAL INFERENCE

Unit 1: Sampling distribution

Introduction – The distribution of the mean – The distribution of the mean finite population – The chi square distribution – The t-distribution – The F-distribution.

Unit 2: **Estimation theory**

Introduction – Unbiased estimators – Cramer-rao inequality – Efficiency – Consistency- Sufficiency – Neyman factorization theorem – The method of moments – The method of maximum likelihood.

Unit 3: **Estimation application**

Introduction – Estimation of means – Estimation of difference between means – Estimation of proportions – Estimation of difference between proportions – Estimation of variances – Estimation of ratio of two variances.

Unit 4:Statistical hypothesis

Statistical hypothesis - Testing a statistical hypothesis - Test concerning means - Test concerning difference between means - Test concerning Variances - Test concerning proportions - Test concerning differences among k proportions - The analysis of r × c table - Goodness of fit.

Text book

Irwin Miller, Marylen Miller – John E. Freund's. Mathematical Statistics with applications – 6thedition , Prentice hall.

Sections: 8.1-8.6, 10.1-10.5, 10.7 & 10.8, 11.1-11.7, 12.1, 12.2, 13.1 -13.8

Reference books:

1. V.K. Rohatgi - An introduction to probability theory and mathematical statistics - Wiley Eastern Limited, 1988.

2. S.C. Gupta and V.K. Kapoor - Fundamentals of mathematical statistics - Sultan chand and sons, 2003.

3. Paul G. Hoel - Introduction to mathematical statistics - 5th edition - John wiley and sons, 1984.

4. Sheldon M. Ross - Introduction to probability and statistics for engineers and scientists - 3rd edition - Academic press, 2005

MATH-INT : INTERNSHIP/MINI PROJECT

All students will have to undergo a two weeks Internship (during semester vacation between second and third semester) in teaching of Mathematics at the school level which has to be duly certified by the Head of the institution and a report should be submitted.

(or)

The student will have to submit a mini project by collecting data and analyzing it by using statistical tools

MAHT – 311: TOPOLOGY

Unit 1 : Topological Spaces

Elementary concepts – Open bases and open sub bases – Separability – Second countability – Lindelof's theorem – Characterization of continuous mappings by basic open set and sub basic open sets – Characterization of open mappings by basic open sets – Weak topologies – Weak topology generated by continuous mappings.

Unit 2 : Compactness

Basic results of compactness – Characterization of compactness by basic and sub basic open covers – The Heine Borel theorem – Products of spaces – Tychonoff's theorem – locally compact space-compactness for metric spaces – Ascoli's theorem

Unit 3 :Seperation

T_1 spaces and Hausdorff spaces – Completely regular spaces and normal spaces – Uryshon's lemma and Tietze extension theorem – The Urysohn imbedding theorem- Stone's-cech compactification

Unit 4 : Approximation

Weierstrass approximation theorem-Stone Weierstrass theorem-Locally compact Hausdorrf space-Extended Stone Weierstrass theorem

TEXT BOOK

Treatments as in "An Introduction to Topology and Modern Analysis" byG.F.Simmons:", Tata Mc- Graw Hill publishing company limited – Edition 2004

SECTIONS:

17-19, 21-30, 35-38.

REFERENCE BOOKS:

1. J.R.Munkers: Topology, Pearson Education Inc., Second Edition, 2000.
2. J.Dugundgi: Topology, Allyn and Bacon, Boston, 1996.
3. C. Wayne patty - Foundations of Topology - Jones and Bartlett - Student edition - 2nd edition,2010.
4. K.P. Gupta - Topology - Pragati edition,19th edition, 2010.

MAHT- 312 : PARTIAL DIFFERENTIAL EQUATIONS

Unit 1 : Classification of PDE

Introduction – Classification of second order PDE – Canonical forms for Hyperbolic, Parabolic and Elliptic equation – Adjoint operator – Riemann's method.

Unit 2 : Elliptic Equation

Derivation of Laplace and Poisson equations- BVP-Some important mathematical tools - Properties of Harmonic functions – Separation of variables – Dirichlet problem for a rectangle – Neumann problem for a rectangle – Interior Dirichlet problem for a circle – Exterior Dirichlet problem for a circle – Interior Neumann problem for circle.

Unit 3 : Parabolic and Hyperbolic equations

Boundary conditions-Elementary solutions of the Diffusion equation – Separation of variables method – Solution of one dimensional wave equation by canonical reduction – The initial value problem and D'Alembrt's solution – Vibrating string – Variables separable solution.

Unit 4 : Green's functions

Green's function – Introduction – Greens function for Laplace equation – The method of images – Greens function for wave equation – Helmholtz theorem – Greens function for diffusion equation.

TEXT BOOK

K.Sankararao – Introduction to Partial Differential Equations, 2nd edition– Prentice Hall of India Pvt. ltd., 2009.

SECTIONS:

1.1-1.5, 2.1-2.10, 3.2,3.3,3.5, 4.3(except example 4.3), 4.4, 4.5, 5.1-5.3, 5.5 and 5.6

REFERENCE BOOKS:

1. Ian N. Sneddon – Elements of Partial Differential Equations – Mc graw hill International edition 1984.

2. T. Amarnath – An elementary course in PDE – Narosa publishing house, 2009.

3. F. John – Partial Differential Equations – Springer 1982.

4. L.C. Evans – Partial Differential Equations – American Mathematical Society providence 1998.

MAHT-313: CLASSICAL DYNAMICS

Unit I : Introductory concepts

The Mechanical System – Equations of Motion - Generalized Coordinates – Configuration – Holonomic, Non-Holonomic and unilateral constraints - Principle of Virtual Work – D'Alembert's principle - Energy and Momentum – conservation of energy – Konig's theorem .

Unit II : Lagrange's Equations

Derivation of Lagrange's Equations – Examples (Spherical Pendulum, Double Pendulum, Lagrange's Multiplier method to solve for the interaction force between the blocks of masses m_1 & m_2) – Integrals of Motion – Ignorable Coordinates – Example – The Kepler Problem – Routhian Function.

Unit III : Hamilton's Equation

Stationary values of a function – Brachistochrone problem – Geodesic problem - Hamilton's Principle – Hamilton's canonical Equations – forms of Hamilton functions Legendre transformation.

Unit IV :Canonical Transformation

Canonical transformation - Examples – Principal forms of Generating Functions – examples – Special transformations – Homogeneous canonical transformations - Lagrange and Poisson Brackets.

TEXT BOOK

Classical Dynamics by Donald T.Greenwood, Prentice Hall of India Private limited New Delhi 1977.

SECTIONS

Chapter 1: Sec 1.1 to 1.5
Chapter 2: Sec 2.1 to 2.3
Chapter 4: Sec 4.1 to 4.2
Chapter 6: Sec 6.1 to 6.3

REFERENCE BOOKS

1. Herbert Goldstein - Classical Mechanics - Narosa Publishing House, New Delhi 1998.
2. Bhatia V.B - Classical Mechanics - Narosa Publishing House, New Delhi 1997, I Edition.
3. Sankara Rao K.- Classical Mechanics – Prentice hall of India Pvt. Ltd. New Delhi, 2005.

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MAHT- 416: MEASURE THEORY

UNIT I : Measure on the Real Line

Lebesgue outer Measure- Measurable sets – Regularity – Measurable Functions.

UNIT II : Integration of Functions of a Real Variable

Integration of Non-negative Functions-The General Integral-Integration of Series-Riemann and Lebesgue Integrals

UNIT III : Differentiation

Continuous Non-differentiable Functions- Functions of bounded variation - Lebesgue's Differentiation Theorem-Differentiation and Integration-The Lebesgue Set

UNIT IV: Abstract Measure Spaces

Measures and Outer Measures-Extension of Measure-Uniqueness of the Extension-Completion of a Measure-Measure Spaces-Integration with respect to a Measure

TEXT BOOK

Measure Theory and Integration by G.de Barra

SECTIONS

2.1 -2.5, 3.1 – 3.4, 4.2 - 4.6, 5.1-5.6 .

REFERENCE BOOKS

1. **Real Analysis by H L ROYDEN**
2. **Measure and Integration by Inder K Rana**
3. **Measure Theory by P R Halmos**
4. **Measure Theory by Donald Cohen.**

MAHT-417: FUNCTIONAL ANALYSIS

Unit 1 :Banach Spaces

The definition and some examples of Banach spaces – Continuous linear transformations – Norm of a linear transformation - Operator on a normed linear space - Conjugate space of N - The Hahn-Banach Theorem - Second conjugate space of N.

Unit 2 : Hilbert Spaces

The open mapping theorem – Projection on a Banach space - The closed graph theorem - The conjugate of an operator – The uniform boundedness theorem - Isometric isomorphism of $\mathcal{B}$(N) into $\mathcal{B}(N^*)$ - Hilbert spaces – The definition and some simple properties – Schwarz inequality - Parallelogram law - Orthogonal complements – Orthonormal sets - Bessel's inequality - Complete orthonormal set.

Unit 3 :Operators

The conjugate space H^* - The adjoint of an operator – Properties of the adjoint operator on $\mathcal{B}(H)$ - Self adjoint operators – Normal and unitary operators - Necessary and sufficient condition for an operator on H to be normal and unitary.

Unit 4 : Spectral Theory

Definition of Projections - Perpendicular projection - Projection as an operator - Related theorems - Finite dimensional spectral theory - Eigen values and Eigen vectors of an operator T on a Hilbert space - Eigen space of T - Matrices - Determinants and the spectrum of an operator - Spectral theorem .

TEXT BOOK

"An Introduction to Topology and Modern Analysis " BY G.F.Simmons,

Tata Mc Graw hill publishing company limited – Edition 2004.

SECTIONS:

46 – 48, 50 - 62.

REFERENCES BOOKS

1. M.ThambanNair: Functional Analysis – A first course – prentice hall of India, Pvt. limited, New delhi – 2002.

2. D.Somasundaram: A first course in functional analysis – Narosa publishing house – 2008

3.R.V. Limaye: Functional analysis – Wiley eastern, New delhi – 1981.

4. K. Chandrasekhara Rao - Functional analysis - Narosa publishing house - Reprint 2004

5. S.Ponnusamy:Foundation of Functional Analysis , Narosa- 2002

MAHT-418: OPERATIONS RESEARCH

UNIT-I : Linear Programming Problems

Introduction-Graphical solution-some exceptional cases-General LPP- canonical and standard forms of LPP-Computational Procedure-Use of artificial variables-Duality and Simplex method-Dual simplex method.

UNIT –II : Special cases of LPP

General Transportation Problem-Formulation of the transportation problem-solution of transportation problem- finding initial basic feasible solution –degeneracy- transportation algorithm - Transhipment problem-Assignment problem – Travelling salesman problem.

UNIT-III : Integer Programming and Sequencing problems

Integer Programming: Introduction-Gomary's all IPP method- Branch and Bound Technique Sequencing problem: problems of sequencing- processing of n jobs through 2 machines – processing of n jobs through k machines- processing of 2 jobs through k machines .

UNIT–IV : Decision Analysis and Game Theory

Decision Analysis: Decision making problem- Decision making process- decision making environment- Decisions under Uncertainty- Decisions under risk.

Game Theory: The maximin- minimax principle- Games without saddle points–Dominance-graphical method-Arithmetic method for nxn –general solution of mxn rectangular games

TEXT BOOK :

Operations Research byKantiSwarup, P.K. Gupta, Manmohan - Sultan chand& Sons, New Delhi, 12th Edition.

SECTIONS : 3.1 to 3.5, 4.3, 4.4, 5.7, 5.9, 10.1 to 10.12,10.16,11.1 to 11.6,7.1 to 7.6, 12.1 to 12.6, 16.1 to 16.6, 17.1 to 17.9

REFERENCE BOOKS:

1. Hamdy A.Taha, Operations Research An Introduction. Phi Learning Private Ltd. New Delhi, 8th Edition
2. S.D.Sharma, Operations Research, Kedarnath,14th edition
3. P.R. Vittal, Introduction to Operations Research, Margham Publications, Chennai, 2nd Edition.
4. P.K. Gupta, D.S. Hira, Problems in Operations Research, Principles and Solutions, S. Chand & Company Ltd., New Delhi.
5. R. Pannerselvam, Operations Research,Prentice Hall of India, 2nd Edition, 2006
6. S.D.Sharma, Operations Research, Kedarnath,14th edition

LIST OF OPTIONAL

PAPERS OFFERED

BY

THE DEPARTMENT

DISCRETE MATHEMATICS

Unit I : Lattices

Set - Relation – Relation matrix and graph - Partition and covering of a set - Equivalence relation – Composition of binary relation - Partial Ordering – Partially ordered set – Lattices as partially ordered sets – Properties of lattices – Lattices as Algebraic systems – Sub lattices – Direct Product – Homomorphism.

Unit II : Boolean Algebra

Special lattices (Complete lattices, bounded lattices, complemented lattices, distributive lattices and their properties) - Boolean Algebra – Sub algebra – Direct product – Homomorphism.

Unit III : Canonical Forms

Join-irreducible elements, atoms – Boolean Forms - Min terms, sum-of-product canonical form , Max terms, Product of sum canonical form – Free Boolean Algebra.

Unit IV : Boolean functions

Values of Boolean Expression (a binary valuation process) – Boolean Function – Symmetric Boolean Expression- Representation of Boolean functions - Karnaugh map for 2,3 ,4 variables only - minimization Boolean function using Karnaugh map

TEXTBOOK

Discrete Mathematical Structures with application to Computer science by J.P Tremblay and R. Manohar , Tata McGraw-Hill

SECTIONS

Chapter 2: Sections 2-1.1 to 2-1.9, 2-3.1 to 2-3.5, 2-3.7 to 2-3.9

Chapter 4: Sections 4-1, 4-2, 4-3.

REFRENCE BOOK

1. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Edition, Asia, Delhi, 2002
2. KolmanB.,Busby R.C and Ross S.C., Discrete Mathematical Structures, Pearson Edn. Pvt. Ltd. New Delhi,2003

NETWORK ANALYSIS AND QUEUEING THEORY

UNIT-I : Network Analysis :

Introduction to Networks- Minimal Spanning tree Algorithm- Shortest Path Problem- Maximal Flow problem.

UNIT – II : Project Management:

Introduction – Critical Path Method – Critical path determination – Optimal scheduling by CPM-PERT

UNIT-III : Single Server Queueing Models :

Structure of queueing systems-perfomance measures of queueing systems-Probability distribution of queueing systems – classification of queueing models- single server queueing model with infinite and finite capacity

UNIT-IV :Multi Server Queueing Models

Multi server queueing model with infinite and finite capacity - Finite population of arrivals in single and multi server models

TEXT BOOKS:

1. **Introductory Operations Research Theory and Applications by H.S Kasana and Kumar, Springer 2007.**
2. **Operations Research Theory and Applications by J.K. Sharma, Macmillan Fifth Edition.**

SECTIONS:

Chapter 8 : 8.1-8.4 (Text book 1)

Chapter 9 : 9.1-9.5 (Text book 1)

Chapter 16 : 16.1- 16.8 (Text book 2)

REFERENCE BOOKS:

1. F.S. Hillier and J. Lieberman – Introduction to Operations Research (8^{th} Edition), Tata McGraw Hill Publishing company, New Delhi, 2006.
2. Beightler. C, D. Phillips, B. Wilde, Foundations of Optimization (2^{nd} Edition) Prentice Hall Pvt Ltd., New York, 1979.
3. Bazaraa, M.S; J.J. Jarvis, H.D. Sharall, Linear Programming and Network flow, John Wiley and sons, New York 1990.
4. Gross, D and C.M. Harris, Fundamentals of Queueing Theory, (3^{rd} Edition), Wiley and Sons, New York, 1998.
5. Hamdy A. Taha, Operations Research (6^{th} Edition),Prentice – Hall of India Private Limited, New Delhi.

INTEGRAL TRANSFORMS

Unit I : Fourier Integrals & Fourier Transforms:

Fourier integral representations- Proof of the Fourier integral theorem-Fourier transform Pairs-Properties of Fourier transform – Transforms of more complicated functions-convolution integrals of Fourier

Unit II : Laplace Transform:

Transforms of some typical functions-basic operational properties-Transforms of more complicated function -Inverse Laplace transform- Complex inversion formula –evaluating integrals – solutions of ODE and PDE- linear integral equations.

Unit III: Mellin Transform:

Evaluation of Mellin transforms -complex variable method and applications- table of Mellin transforms.

Unit IV: The Hankel Transforms:

Evaluation of Hankel transforms – applications – table of Hankel transforms.

TEXT BOOK

1. **Larry Andrews, BhimsenShivamoggi. Integral Transforms for Engineers, Prentice Hall of India, New Delhi, 2005.**

SECTIONS:

Chapter 2: 2.1-2.7,
Chapter 4 4.1- 4.6,
Chapter 5: 5.1-5.5.
Chapter 6: 6.1-6.5.
Chapter 7: 7.1-7.4.

REFERENCE BOOKS

1. N. Sneddon,The use of Integral Transforms, New York : Mac Graw Hill 1974.
2. Ronald N. Bracewell, The Fourier transform and its applications : Mac Graw Hill 2003.
3. Allan Pinkus and SamyZafrany, Fourier Series and Integral Transforms : Cambridge University Press: 1997

Introduction to Fuzzy sets and its applications

UNIT – I Interval arithmetic and multi–level interval numbers

Interval Numbers – Arithmetic Operations – Rules for Operations – Distance Between Intervals - Interval Operations in Z – Exercises –Two-Level Interval Numbers – Arithmetic Operations with Two- Level Intervals - More General Two-Level Intervals - Interval Numbers with n Levels – General n-Level Intervals - Infinite-Level Interval Numbers - Exercises

UNIT – II Fuzzy sets

Definition of Fuzzy sets –Fuzzy Sets and Fuzzy Numbers – Basic Operations on Fuzzy Sets – Properties of Fuzzy sets – Algebraic Product and Sum of Fuzzy Sets – Power and Related Operations on Fuzzy Sets - The Extension Principle – Exercises

UNIT – III Fuzzy relations

Definitions of Fuzzy Relation – Basic Operations on Fuzzy Relations – Direct Product – Projections of a Fuzzy Relation – Max–Min and Min–Max Compositions – Basic Properties of Fuzzy Relations - Fuzzy Relations and Approximate Reasoning – Exercises

UNIT – IV Fuzzy control systems

Introduction – Fuzzy Control Structure – Modelling the Control Parameters – If… and...Then Rules – Rule Evaluation – Conflict Resolution – Defuzzification - Exercises

TEXT BOOK

1. George Bojadziev and Maria Bojadziev, Fuzzy Sets, Fuzzy Logic, Applications, World Scientific Publishing Co.Pte. Ltd. Singapore, 1995

SECTIONS

Chapter 1 : 1.1 – 1.6
Chapter 2 : 2.1 – 2.7
Chapter 6 : 6.1 – 6.8
Chapter 7 : 7.1 – 7.8
Chapter 11 : 11.1 – 11.6,11.9

REFERENCE BOOKS

1. George J.Klir/Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, 2000

2. George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice-Hall of India, 1993

NUMERICAL METHODS

Unit I : Solution of Algebriac and Transendental Equation

Introduction – The Bisection Method – The Iteration Method – Aitken's Δ^2 –Process – The Method of False Position – Newton-Raphson Method – Ramanujam's Method – Muller's Method – Graeffe's root squaring method – Lin-Bairstow's Method.

Unit II : Matrices and Linear system of simultaneous Equations

Gausian Elimination Method – Modification of the Gauss Method to Compute the Inverse – Method of Factorization – LU decomposition – Solution of Centro-Symmetric Equations – Ill-Conditioned Linear Systems – Method of Ill-Conditioned Matrices. solutions of Linear Systems – Iterative Methods- The Eigen Value Problem – House Holder's Method.

Unit III : Numerical solutions for ODE

Introductions – Solution by Taylor's series– Picard's Method for Successive Approximation – Euler's Method - Runge-Kutta Method - Predictor Correcter Method – Boundary Value Problems – Finite Difference Method – The Shooting Method- Cubic Spline.

Unit IV : Numerical solution for PDE

Introduction – Finite Difference Approximation to Derivatives – Laplace and Poisson Equation – Jacobi's Method – Gauss-Seidel Method – Parabolic Equation – Iterative Methods for the Solution of Equations – Hyperbolic Equations.

TEXT BOOK : Introductory methods of Numerical Analysis BYS.S.Sastry – Prentice Hall of India (III edition)

SECTIONS

Chapter 2 – Sec. 2.1 – 2.9

Chapter 6 – Sec. 6.3.2 – 6.5.2

Chapter 7 – Sec. 7.1 – 7.6, 7.10.1 - 7.10.3

Chapter 8 - Sec. 8.1 – 8.3.2, 8.4 – 8.6

REFERENCE BOOKS

1. M.K.Jain - Numerical Solution of Differential Equations -Wiley Eastern Ltd. 1979.
2. M.K.Jain , S.R.K Iyengar, R.K.Jain – Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, (IV edition)

B.D Gupta – Numerical Analysis – Konark Publishers Pvt. Ltd. – I edition

FLUID DYNAMICS

UNIT 1 : Kinematic of Fluids in Motion

Real and Ideal Fluids-Velocity of a fluid at a point - Streamlines and path lines - Steady and unsteady flows - The velocity potential - The vorticity vector - Local and particle rates of change - The equation of continuity –worked example-acceleration of a fluid- conditions at a rigid boundary.

UNIT 2: Equations of Motion of a Fluid

Euler's equations of motion - Bernoulli's equation - Worked examples - Discussion of the case of steady motion under conservative body forces - Some flows involving axial symmetry - Some special two dimensional flows.

UNIT 3: Two dimensional flows

The stream function - The complex potential for two dimensional, Irrotational, Incompressible flow - Complex velocity potentials for standard two dimensional flows - Some worked examples - The Milne-Thomson circle theorem - The theorem of Blasius – Schwarz- Christoffel Transformation

UNIT 4 : Three dimensional flows

Introduction - Sources, Sinks and Doublets - Images in a rigid infinite plane - Images in solid spheres - Axi-symmetric flows - Stoke's stream function - Some special forms of the stream function for Axi-symmetric irrotational motions.

TEXT BOOK:

F. Chorlton - Text book of Fluid dynamics - CBS Publishers and Distributors - Reprint 1998.

SECTIONS

2.1 - 2.10, 3.4 - 3.7, 3.9, 3.10, 4.1 - 4.5, 5.3 – 5.6, 5.8, 5.9, 5.11

REFERENCE BOOKS:

1. L.M.Milne -Thomson- Text book of Theoretical Hydrodynamics-Fourth edition -

London Macmillan & Co LTD., 1962

2. J.K. Goyal and K.P. Gupta - Fluid dynamics - Pragati edition - 16th edition 2009.

3. Yunus A. Cengel and John M. Cimbala - Fluid mechanics - Tata McGraw hill

education Pvt. Ltd.

PROBABILITY THEORY

UNIT 1 : Random Variable

Random variables – Probability distributions – Continuous random variables – Probability density functions – Multivariate distributions – Marginal distributions – Conditional distributions.

UNIT 2 : Mathematical Expectation

The expected value of a random variable – Moments – Chebyshev's theorem – Moment generating function – Product moments – Moments of linear combination of random variables – Conditional expectation.

UNIT 3 : Discrete distribution

The discrete uniform distribution – Bernoulli distribution – Binomial distribution – Negative binomial and Geometric distribution – Hyper-geometric distribution – Poisson distribution – Multinomial distribution – Multivariate hyper-geometric distribution.

UNIT 4 : Continuous distribution

Uniform distribution – Gamma and Exponential distributions – Chi – square distribution- Beta distribution – Normal distribution – Normal approximation to Binomial distribution – Bi-variate normal distribution.

TEXT BOOK:

Mathematical statistics with applications byIrwin Miller, Marylees Miller – John E.Freund's – 6th edition .

SECTIONS: 3.1 – 3.7, 4.1 – 4.8, 5.1 – 5.9 and 6.1 – 6.7.

REFERENCE BOOKS:

1. V.K. Rohatgi - An introduction to probability theory and mathematical statistics - Wiley Eastern Limited, 1988.

2. S.C. Gupta and V.K. Kapoor - Fundamentals of mathematical statistics - Sultan chand and sons, 2003.

3. Paul G. Hoel - Introduction to mathematical statistics - 5th edition - John wiley and sons, 1984.

4. Sheldon M. Ross - Introduction to probability and statistics for engineers and scientists - 3rd edition - Academic press, 2005.

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

UNIT I :Variational Problems with fixed boundaries

Concept of Variation of functionals and its Properties – Euler's Equations – Variational problems for functional of the form – functional dependent on higher order derivatives – functional dependent on functions of several independent variables – Variational problems in parametric form.

UNIT II :Variational problems with subsidiary conditions

Constraints of the form isoperimetric problems- Problems of Mayer and Bolza – Equalibrium problem for elastic bodies- Castigliano principals- introduction to direct methods – Euler method of finite difference- Rayliegh Ritz method – Galerkin method

UNIT III :Fredholm and Volterra Equations

Fredholm and Volterra Equations of I and II kinds – Relation between Integral and Differential Equations – Green's Functions (problem).

Unit IV :Fredholm Equations with seperableKernals

Fredholm Equations with separable kernels – Illustrative Examples – Hilbert Schmidt Theory – Iterative Methods for Solving Equation of Second Kind.

TEXT BOOK

1. **Gupta.A.S – Calculus of Variation with applications – Prentice hall of India,1997.**
2. **F.B.Hilderbrand - Methods of Applied Mathematics – Prentice hall of India, (II edition), 1992.**

SECTIONS

Chapter 1: Sec 1.1 – 1.6 (Text book 1)

Chapter 4: Sec 4.1,4.2 (Text book 1)

Chapter 6: Sec 6.1- 6.4 (Text book 1)

Chapter3: Sec 3.1 to 3.3 and 3.6 to 3.9 (Text book 2).

NUMBER THEORY

UNIT I : Divisibility

Introduction – Divisibility – Primes – binomial theorem.

UNIT II : Congruences

Congruences – Solutions of congruences – The Chinese Remainder theorem – public key Cryptograghy - Prime power moduli – Prime modulus.

UNIT III

Primitive roots and power residues – Congrunces of degree two, prime modulus – Quadratic reciprocity: Quadratic residues – Quadratic Reciprocity – The Jacobi symbol.

UNIT IV

Some functions of number theory: Greatest integer functions – Arithmetic functions – The Moebius Inversion formula – Recurrence functions.

TEXT BOOK

An Introduction to the theory of Numbers by Ivan Nivan, Herbert S. Zuckerman and Hugh L. Montgomery – John wiley& Sons (Fifth edition)

SECTIONS

Chapter I Sections: 1.1 – 1.4

Chapter II Sections: 2.1 to 2.3, 2.5 to2.9

Chapter III Sections: 3.1 to 3.3

Chapter IV Sections: 4.1 to 4.4.

REFERENCE BOOKS

1. David M.Burton – Elementary Number Theory – Tata MC Graw Hill Publishing Company Ltd.,(VI edition).
2. Martin Erickson & Anthony Vazzana – Introduction to Number Theory – Chapman & Hall / CRC.
3. TomM.Apostal – Introduction to Analytic Number Theory – Spinger International Student Edition – Narosa Publishing house.`

SCILAB

UNIT – I

Overview of Scilab - How to get started with Scilab - Getting help from Scilab demonstrations and macros – The Console – The Editor – Batch Processing Creating Real Variables - Elementary mathematical functions – Booleans – Complex Numbers – Integers – Floating Points – Strings – Dynamic Variables

UNIT – 2

Matrices – Create Matrices of Real Variables – Accessing Elements of Matrices - Matrices are dynamic – Elementwise Operations Conjugate transpose and non-conjugate transpose - Multiplication of two vectors Comparing two real matrices - Issues with floating point integers - More on elementary functions - Higher-level linear algebra features

UNIT – 3

Looping and branching - The if, select, for and while statements The break and continue statements Functions - Function libraries - Managing output arguments Levels in the call stack - The return statement - Debugging functions with pause

UNIT - 4

Plotting - 2D plot - Contour plots - Titles, axes and legends - Export

Text Book: 1.

1. Introduction to Scilab - Michael BaudinFrom Scilab Consortiun, 2010 Chapters 1 to 8
2. Plotting Using Scilab – An open Source Document – www.openeering.com

References:

1. Modeling and Simulation in Scilab, Stephen L. Campbell, Jean-Philippe Chancelier and RamineNikoukhah
2. An Introduction to Scilab from a Matlab User's Point of View by Eike Rietsch

DIFFERENCE EQUATIONS and Z- TRANSFORMATION

UNIT 1 : Difference Operator

Difference operator – Definition of difference operator **Δ** and shift operator E -Properties of **Δ** - Formula for differences of particular functions - The falling factorial power and Binomial coefficient - Summation – General properties of indefinite sums - Generating function and approximate summation - Bernoulli polynomials and Bernoulli numbers - Properties of Bernoulli polynomials - Euler summation formula.

UNIT 2 : Linear difference Equations

First order equation – General results for linear equations – A linear equation of n^{th} order - Characterization of general solution of a linear equation of n^{th}order - The matrix of Casorati - Role of Casoratian in the study of linear difference equations - Solving linear equations - Applications.

UNIT 3 : Z- Transform

Z-Transform – Definition of Z-transform of a sequence - Exponentially bounded sequence - Linearity theorem – Shifting theorem - Initial and final value theorem – Convolution theorem - Solution of Volterra summation equation - Solution of Fredholm equation - Eigen pair - Properties of eigen pairs.

UNIT 4 : Stability Theory

Stability theory – Initial value problems for linear system – Cayley Hamilton theorem - The Putzer algorithm - Variation of parameters formula for solving non-homogeneous system.

TEXT BOOK:

Walter G Kelley & Allan C. Peterson : "Difference equations ", Academic press-second edition, 2001.

SECTIONS:

1.1 –2.3 , 3.1 – 3.4, 3.7, 4.1

REFERENCE BOOKS:

1. Dr. Sudhir, K.Pundir and Dr. RimplePundir - Difference equations - UGC model curriculum.

2. Ronald E. Mickens - Difference equation - Theory and application - Chapman and Hall , Second edition, London 1990.

GRAPH THEORY

UNIT-I: GRAPHS, SUBGRAPHS AND TREES

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.

UNIT – II : CONNECTIVITY, EULER TOURS AND HAMILTON CYCLES

Connectivity – Blocks – Euler tours – Hamilton Cycles.

UNIT-III : MATCHINGS, EDGE COLOURINGS

Matching's – Matching's and Coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Theorem.

UNIT-IV: INDEPENDENT SETS AND CLIQUES, VERTEX COLOURINGS

Independent sets – Ramsey's Theorem – Chromatic Number – Brook's Theorem

TEXT BOOK
J.A. Bondy and U.S.R. Murthy, Graph Theory and Applications, Macmillan, London, 1976.

SECTIONS

Chapter 1 (section 1.1-1.7)

Chapter 2(section 2.1 - 2.3)

Chapter 3 (Section 3.1 - 3.2)

Chapter 4 (Section 4.1 - 4.2)

Chapter 5 (Section 5.1 – 5.2)

Chapter 6 (Section 6.1 - 6.2)

Chapter 7 (Section 7.1 – 7.2)

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REFERENCE BOOKS

1. J. Clark and D.A. Holton, A First Look at Graph Theory, Allied Publishers, New Delhi, 1995.

2. R. Gould. Graph Theory, Benjamin/ Cummings, Menlo Park, 1989.

3. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge, 1989.

4. R.J. Wilson and J.J. Watkins, Graphs : An Introductory Approach, John Wiley and Sons, New York, 1989.

5. R.J. Wilson, Introduction to Graph Theory, Pearson Education, 4th Edition, 2004, Indian Print.

6. S.A. Choudum, a First Course in Graph Theory, MacMillan India Ltd. 1987.

STOCHASTIC PROCESSES

Unit 1: **Introduction to Stochastic process**

Introduction- Specification of Stochastic Processes – Markov process - Second order processes - Stationary – weakly stationary - Strictly stationary - Evolutionary - Gaussian processes - Martingales - Definition and examples - Martingale convergence theorem.

Unit 2 : Markov Chains

Markov chains - Definition and Examples – Transition matrix - order of a Markov chain - Higher Transition probabilities - Generalisation of Independent Bernoulli Trials - Sequence of Chain Dependent Trials - Classification of States and chain - Determination of higher transition probabilities – Stability of a Markov system – Graph Theoretic Approach.

Unit 3 : Poisson process

Poisson process - Postulates for Poisson process - Properties of Poisson Process - Poisson process and related distribution - Generalisation of poison process – Pure birth process , Birth - Immigration process -Time dependent Poisson process - Birth and Death process.

Unit-4 : Queueing systems

Concepts of queueing system - Queueing process and notation - Steady state distribution - Little formula - M/M/1 Queueing model - Steady State Behaviour and solution - Waiting time distribution - M/M/1/K queueing model - Transient Behaviour of M/M/1 model - Multi channel queueing model - M/M/∞ queueing model - M/M/s/s loss system- Model with Finite input source.

TEXT BOOK: J. Medhi - Stochastic Processes -2ndedition .

SECTIONS:

Chapter 2: Sec. 2.1 – 2.4

Chapter 3: Sec. 3.1 – 3.7

Chapter 4: Sec. 4.1 – 4.4

Chapter 10 : Sec . 10.1 - 10.4

Reference books:

1. Athanasios Papoulis and S. Unnikrishnapillai - Probability, Random variables and Stochastic processes - Tata Mcgraw hill edition - 4th edition,2002.

2. S.K. Srinivasan and K.M. Mehata - Stochastic processes - Tata McGraw hill publishing company limited, New delhi, 1976.

3. Kishor S. Trivedi - Probability and Statistics with Reliability, Queueing and Computer science applications - Prentice hall of India, New Delhi 2000.

AUTOMATA THEORY

Unit 1 : Grammar and Language

Languages - Star-closure of a language - Definition of a Grammars - Language generated by a grammar Automata – Transition function - deterministic automata - non-deterministic automata - Some application.

Unit 2 : Finite state machine

Deterministic finite accepters – Non deterministic finite accepters – Equivalences of deterministic and Non- deterministic finite accepters – Reduction of the number of states in finite automata.

Unit 3 : Regular Languages and Regular grammar

Regular expression – Formal dentition and examples - Languages associated with Regular expressions - Connection between regular expression and regular language – Regular grammar - Right and Left Linear Grammars - Right linear Grammars Generate Regular Languages - Right Linear Grammars for regular Languages - Equivalence between Regular Language and Regular Grammars

Unit 4 :Properties of regular languages

Closure properties of regular languages – Closure under Simple set operations - Closure under other operations - Elementary problems in regular languages.

Text book:

Peter linz - An Introduction to formal languages and Automata - 3rd edition, 2004.

Sections: 1.2, 1.3, 2.1 – 2.4, 3.1 – 3.3, 4.1 and 4.2

Reference book:

1. John C.Martin - Introduction to languages and the theory of computation –3rd edition, 2004.

2. S.F.B. Nasir and P.K. Srimani - A textbook on Automata theory - 2010.

3. Ullmann - Introduction to Automata theory, Languages and Computation - 1998.

DIFFERENTIAL GEOMETRY

UNIT I

Graphs and level sets-vector fields-the tangent space

UNIT II

Surfaces-vector fields on surfaces-Orientation-The Gauss map

UNIT III

Geodesics-Parallel transport

UNIT IV

The Weingantten map-Curvature of plane curves

UNIT V

Arc length and line integrals- curvature of surfaces

J.A.Thorpe: Treatment as in Elementary Topics in Differential Geometry,springer,2004

Chapters 1 to 12.

GENERAL MATHEMATICS

Unit 1:

Average – Problems on Numbers – Problem on ages –Percentage

Unit 2:

Profit and Loss – Ratio and Proportion – Simple and compound interest

Unit 3:

Time and work – Time and distance – Problems on train

Unit 4:

Linear and quadratic equations – Arithmetic and Geometric Progression

Text Book:

Objective Arithmetic – R S Agarwal – S Chand Publication -2011 Edition

Chapters: 6,7,8,10,11,12,15,16,18,21,22,31,32,33

Reference Book:

1. Quantitative Aptitude by R S Agarwal
2. Quantitative Aptitude by Abhijith Gupta
3. Quick Arithmetic by R S Agarwal

KANCHI MAMUNIVAR CENTRE FOR POSTGRADUATE STUDIES

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M.Phil. - MATHEMATICS

(Effect from 2019 - 2020)

SYLLABUS

DEPARTMENT OF MATHEMATICS

KMCPGS

KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDIES
(Autonomous) PUDUCHERRY-605008.
DEPARTMENT OF MATHEMATICS
M.Phil. SYLLABUS (CBCS)
From 2019-20 Batch Onwards

Semester	Code	Title of the paper	Credits	Theory	Total Credits
I	MHHT-11	Advanced topics in Analysis and Algebra	6	6	18
	MHHT-12	Difference and Differential Equations	6	6	
	MHHT-13	Area Paper* (Internal to be prescribed by supervisor concerned)	6	6	
	seminar/assignment/test/mid-semester			12	
II	MHHD-22	Dissertation	15	15	18
	MHHV-23	Viva-Voce	3	3	
	Pre-submission seminars			12	

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(Autonomous) PUDUCHERRY-605008.
DEPARTMENT OF MATHEMATICS
M.Phil.,. Scheme of Examination
From 2019-20 Batch Onwards

Sem ester	Code	Title of the paper	Internal	External	Total
I	MHHT-11	Advanced topics in Analysis and Algebra	40	60	100
	MHHT-12	Difference and Differential Equations	40	60	100
	MHHT-13	Area Paper* (Internal to be prescribed by supervisor concerned)	40	60	100
II	MHHD-22	Dissertation	50	100	150
	MHHV-23	Viva-Voce	---	50	50
	Grand Total				**500**

QUESTION PATTERN FOR M.Phil

Each paper will have 100 marks with CIA (40 marks) and end semester examination (60 marks)

CIA

The CIA component of 40 marks shall have the following split-up

Best 2 tests out of 3	15 marks
Mid-Semester examination	15 marks
Seminar/Assignment	10 Marks

External examination

Question Paper Pattern

Part A consists of 10 questions and each question carries 1 mark (10x1 = 10)

Choose not less than two questions from each unit.

Part B consists of 5 Questions of internal choice type (5X4=20)

Choose questions compulsorily from each unit.

Part C consists of 5 questions and answers any three (3X10=30).

Choose Five questions from four units. Do not omit any unit.

PAPER –I: ADVANCED TOPICS IN ANALYSIS AND ALGEBRA

Unit I: Group Actions

Group Actions and Permutation Representations-Groups Acting on Themselves by Left Multiplication-Cayley's Theorem-Groups Acting on Themselves by conjugation-The Class Equation-Automorphisms-The Sylow Theorems-The Simplicity of A_{η}.

Unit II: Introduction to Module Theory

Basic Definitions and Examples-Quotient Modules and Module Homomorphisms-Generation of Modules Direct Sums, and Free Modules – Tensor Products of Modules-Exact Sequences-Projective, Injective, and Flat Modules.

Unit III: Abstract integration

Set-theoretic notations and terminology-The concept of measurability-Simple functions – Elementary properties of measures- Arithmetic in $[0,\infty]$.

Unit IV: L^p-Spaces

Integration of positive functions-Integration of complex functions- The role played by sets of measure zero-convex functions and inequalities-The L^p-Spaces-Approximation by continuous functions.

Text book:

1. **Abstract Algebra – WilleyIndia , Second edition**
   Chapter 4- sections 4.1-4.4 , Chapter 10 – sections 10.1-10.5
2. **Real and Complex analysis Mc- Graw hill, Prentice Third**
   Chapter 1 and Chapter 3

PAPER - II: DIFFERENCE AND DIFFERENTIAL EQUATIONS

Unit 1: Finite difference

Difference operator – Definition of difference operator **Δ** and shift operator E -Properties of **Δ** - Formula for differences of particular functions - The falling factorial power and Binomial coefficient - Summation – General properties of indefinite sums - Generating function and approximate summation - Bernoulli polynomials and Bernoulli numbers - Properties of Bernoulli polynomials - Euler summation formula.

Unit 2: Linear difference equations

First order equation – General results for linear equations – A linear equation of n^{th} order - Characterization of general solution of a linear equation of n^{th} order - The matrix of Casorati - Role of Casoratian in the study of linear difference equations - Solving linear equations – Applications- Equations with variable coefficients

Unit 3: Boundary value problem for ODE and PDE

Finite difference method – Shooting method – Cubic Spline method – Solution of Laplace equation- Parabolic equation – Hyperbolic equations.

Unit 4: Finite element method

Functionals- base functions- Rayleigh Ritz method- Galerkin method-Application to two dimensional method – finite element method for one dimensional problem – Application to two dimensional problems.

Text book:1

Walter G Kelley & Allan C. Peterson : "Difference equations ", Academic press- second Edition.

Sections: 2.1 – 2.3 , 3.1 – 3.5

Text book:2

S.S.Sastry: Introductory methods of Numerical Analysis , Prentice Hall India , Fourth Edition.

Chapter 7: sections 7.10.1 - 7.10.3
Chapter 8: sections 8.1, 8.2, 8.3.1 - 8.3.2, 8.4, 8.6
Chapter 9: sections 10.1 - 10.4

Reference books:

1. Dr. Sudhir, K.Pundir and Dr. Rimple Pundir - Difference equations - UGC model curriculum.

2. Ronald E. Mickens - Difference equation - Theory and application - Chapman and Hall , 2nd Edition, London 1990.

3. M.K.Jain - Numerical Solution of Differential Equations -Wiley Eastern Ltd. 1979.

4. M.K.Jain , S.R.K Iyengar, R.K.Jain – Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, (4th Edition)

5. B.D Gupta – Numerical Analysis – Konark Publishers Pvt. Ltd. – 1st Edition.