Devi Ahilya University, Indore
Scheme of Examination — 2016-17
Class M.A./M.Sc. (Semester – IV)
Subject : Mathematics

Paper	Title of the Paper	Max. Marks		Minimum Passing Marks	
	Compulsory	Theory	C.C.E.	Theory	C.C.E.
I	Functional Analysis	85	15	28	05
	Optional Papers Four papers out of the following have to be chosen, opting not more than one from each group.	85	15	28	05
	Group I 1. Advanced Functional Analysis 2. Partial Differential Equations 3. Differentiable Structures on manifolds 4. General Theory of Relativity and Cosmology	85	15	28	05
	Group II 1. Algebraic Topology 2. Abstract Harmonic Analysis 3. Advanced Graph Theory 4. Advanced Special Functions*	85	15	28	05
	Group III 1. Theory of Linear Operators* 2. Mechanics 3. Advanced Numerical Analysis* 4. Fuzzy Sets and their Applications	85	15	28	05
	Group IV 1. Operations Research* 2. Computational Biology 3. Jacobi Polynomials & H-Functions 4. Fluid Mechanics	85	15	28	05
	Group V 1. Wavelets 2. Bio-Mechanics 3. Analytic Number Theory* 4. Integral Transform*	85	15	28	05
	Group VI 1. Fundamentals of Computer Science (Theory & Practical)* 2. Mathematics of Finance & Insurance 3. Integration Theory* 4. Spherical Trigonometry and astronomy	85 (50 Theory & 35 Practical)	15	28	05
VI.	Job - Oriented Project Work.	100		33	
	Grand Total	600			

* Optionals presently being offered.

Note: If any optional other than those marked by * are being offered, due intimation should be given to the University.

Department of Higher Education Govt. of M.P.

Semester wise syllabus for P.G.

As recommended by Central Board of Studies and

Approved by HE the Governor of M.P.

(Partially revised by the Board of Studies in Mathematics, DAVV, Indore on 09-02-2016 and to be effective from academic session 2016-2017)

Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Functional Analysis-II
Paper No.	: I
Compulsory / Optional	: Compulsory

Unit I

Inner Product Space Hilbert Space, Further Properties of Inner Product Spaces Orthogonal complements and Direct sum, Orthonormal Sets and Sequences. Schwarz, triangle and Bessel Inequality.

(1. Chapter 3 Sect 3.1 to 3.4 & Exercises)

Unit II

Series related to orthonormal sequences & sets, Total orthonormal sets & sequences Representation of Functionals on Hilbert Spaces , Riesz's Theorem, Riesz Representation Theorem.

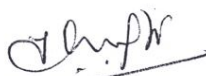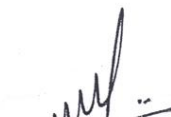(1. Chapter 3 Sect 3.5, 3.6, 3.8 & Exercises)

Unit III

Adjoint operator, Hilbert Adjoint Operator , Self Adjoint Operator, Unitary and Normal Operators

(1. Chapter 3 Sect 3.9 , 3.10, Chapter 4: 4.5 & Exercises)

9.2.16

9|2|16

9-2-2016

09|02|16

KMRajesvari
9-2-2016

Unit IV

Adjoint Operator, Reflexive Spaces, Category Theorem. Uniform Boundedness Theorem, Strong and Weak Convergence.

(1. Chapter 4 Sect 4.6 to 4.8 & Exercises)

Unit V

Convergence of Sequences of Operators and Functionals, Application of Summability of Sequences, Open Mapping Theorem, Closed Linear Operators, Closed Graph Theorem.
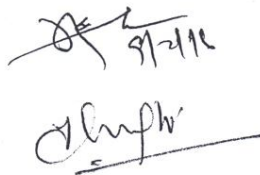
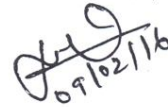(1.Chapter 4 Sect 4.9, 4.10, 4.12, 4.13 & Exercises)

Text Books

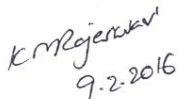**1.E. Kreyszig Introductory Functional Analysis with applications, John Wiley & Sons New York.**
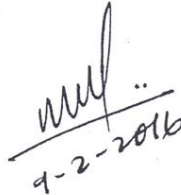
Reference

1. G.F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New York 1963.
2. B. Choudhary and Sudarsan Nanda.Functional Analysis with applications, wiley Eastem Ltd.

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Advanced Special functions-II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-II(4)

Unit – I

Hermite Polynomials :Definition of Hermite Polynomials $H_n(x)$, pure recurrence relations, Differential recurrence relations, Rodrigue's formula, other generating functions, Othogonality, Expansion of Polynomials, more generating functions.

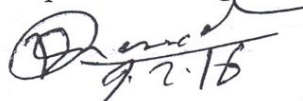(3.Chapter 7 Page 209-238)

Unit –II

Simple Laguerre Polynomials : Solution of Laguerre's Differential Equation, Generating Function, Rodrigue's Formula, Recurrence Relations, Laguerre Polynomials for particular values of n and x, Differential Equation of $L_n(x)$, Orthogonal Property of $L_n(x)$, Other Integral Relation.
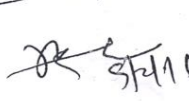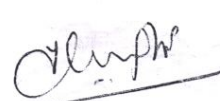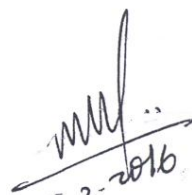
(3.Chapter 8-I Page 239 – 257)

Unit –III

Generalized Laguerre Polynomials :Definition, Recurrence Relations, Rodrigue's Formula and Othogonality, Expansion, Some Special Result, More Generating Relations.

(3.Chapter 8-II Page 257 – 279)

Unit –IV

Chebyshev Polynomials :Independent Solution of Chebyshev's Equation, Expansion of $T_n(x)$ and $U_n(x)$, Generating Functions, Recurrence Relations, To determine $T_n(x)$ and $U_n(x)$ for given value of n, Orthogonal Properties of $T_n(x)$ and $U_n(x)$.
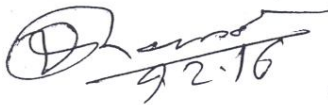
(3.Chapter 9 Page 280 -293)

Unit –V

The Jacobi Polynomials: The Jacobi polynomials, Bateman's generating function, The Rodrigues formula, Orthogonality, Differential recurrence relations, pure recurrence relation
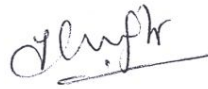
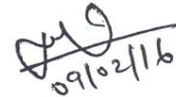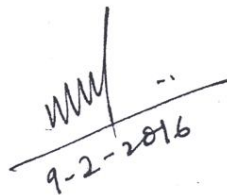(3. Chapter 10 Page 294 – 325)

Text Book

1.   Rainville. E.D,Special functions, The Macmillan co., New York 1971.

2.   Srivastava, H.M. Gupta, K.C. and Goyal, S.P.,The H-functions of One and Two Variables with applications, South Asian Publication, New Delhi.

3.   Saran,N.,Sharma S.D. and Trivedi, - Special Functions with application, Pragati prakashan ,1986.

Department of Higher Education Govt. of M.P.

Semester wise syllabus for P.G.

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Theory of Linear Operators– II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-III(1)

Unit I

Behaviour of compact linear operators with respect to solvability of operator equations, Fredholm type theorems, Fredholm alternative theorem, Fredholm alternative for integral equations.

(1, Chapter 8,Sec 8.5,8.6,8.7).

Unit II

Spectral properties of bounded self adjoint operators on complex Hilbert spaces.

(1, Chapter 9, sec. 9.1&9.2)

Unit III

Positive operators and their square roots.

(1, Chapter 9, sec. 9.3&9.4).

Unit IV

Projections on complex Hilbert spaces and their properties.

(1, Chapter 9, sec. 9.5&9.6,).

Unit V

Spectral family of a bounded self adjoint linear operator and Spectral representation of bounded self adjoint linear operator.

(1, Chapter 9, sec 9.7,9.8& 9.9).

Note : Exercises based on the theory are expected to be solved .

Recommended books:

1. **E.Kreyszig : Introductory Functional Analysis with applications, John wiley & sons, New York.**

Reference Books :

1. P.R.Halmos: Introduction to Hilbert space and the theory of spectral multiplicity, second edition, Chelsea publishing co.NY 1957

2. N.Dunford and J.T.Schwartz, Linear operator-part 3,Interscience/wiley, New York 1958-71

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Advanced Numerical Analysis-II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-III(3)

Unit-I

Extrapolation Methods (Richardson Extrapolation) , Partial Differentiation and its estimations, Ordinary Differential Equations : Initial Value Problems, Reduction Of Higher Order Equation, Existence and Uniqueness, Test equations , System Of Linear First Order Differential Equation With Constant Coefficients and its theorem, Multi Step Methods , Various types of Explicit and Implicit Multistep Methods, General Multi Methods. Examples.

(1.Chapter 5 Section 5.4 , Section 5.5, Chapter 6 Section 6.1 and subsections, Section 6.6 , Definition 6.1,6.2,6.3,6.4 and examples)

Unit- II

Maximum order of k-step methods and theorems, Convergence Of Multi Step Methods, Predicator and Corrector Method, Modified Predicator and Corrector Method, Stability Analysis of Multistep Methods and theorems : First Order and Second Order differential equations.

(1.Chapter 6 Section 6.6 and subsections , Definition , 6.5,6.6,6.7 and examples, Section 6.7 and subsections, Section 6.8 and subsections.)

Unit-III

Ordinary Differential Equation , Boundary Value Problems : Shooting Method, Alternate Method , Nonlinear Second Order Differential Equation.

(1.Chapter 7 section 7.1 , Section 7.2 and subsections)

Unit -IV

Finite Difference Methods Linear Second Order Differential Equations, Local Truncation Error, Derivative Boundary Conditions, Solutions Of Tridiagonal System, Nonlinear Second Order Differential Equation, Convergence Of Difference Schemes and theorems, Stability Of Finite Difference Schemes

(1.Chapter 7 section 7.3 and subsections)

Unit-V

Finite Element Method, Solution f the Variation Problem, Ritz Method (Galerkin equations),Finite Elements, Linear Lagrange Polynomial, Ritz Finite Element Method, Finite element solution of Linear Boundary Value Problems, Assembly Of Element Equations, Mixed Boundary Conditions

(Chapter 7 section 7.4 and subsections)

Text Book
1.   **Numarical Methods, Jain, Iyanger and Jain, New Age International Edition 2012.**

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: OPERATIONS RESEARCH-II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-IV(1)

Unit I

Transportation problems : Introduction, General transportation problem, duality in TP, Transportation Table , LP formulation of T.P., Initial solution of transportation problem : North - West Corner Method, Least – Cost Method, Vogel's Approximation Method, test for optimality by MODI (u-v method) method, economic interpretation, degeneracy in transportation problems, stepping stone algorithm.

(1.Chapter 10 sect 10.1 to 10.14, Examples and Exercises)

Unit II

Assignment problem : Introduction, Mathematical formulation of assignment problem, Solution of assignment problem : Hungarian Method , Special Cases: Unbalanced Assignment Problem, Maximisation Assignment Problems., Prohibited A.P., Dual of the assignment problem, Travelling Salesman problem. Dynamic Programming : Introduction, Characteristics , Dynamic Programming Algorithms.

(1. Chapter 11 sect 11.1 to11.6, Chapter 13 sections 13.1 to 13.4, Examples and Exercises)

Unit III

Network analysis : Introduction , Basic Terminology/Components, Rules of network construction, Critical Path Method (CPM), PERT Calculation, Difference between CPM /PERT.

(1. Chapter 25, sections 25.1 to 25.11, Examples and Exercises)

Unit IV

Game theory : Introduction, Two- person Zero - Sum Games, Basic Terms, The Maximix -Minimax principle, games without saddle points - Mixed strategies, dominance property, Graphical solution of 2xm and mx2 games, Arithmetic method for nxn games, Solution of mxn games by Linear Programming, General solution of mxn rectangular games, Limitations.

(1. Chapter 17, section 17.1 to17.11, Examples and Exercises)

Unit V

Non-Linear programming Techniques Kuhn -Tucker Conditions with Non – negative Constraints, Quadratic Programming, Wolfe's simplex method, Beals method, Separable Convex Programming, Separable programming algoritham.
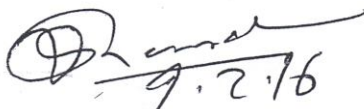
(1. Chapter 27, sections 27.1 to 27.7 , Chapter 28, 28.3 to 25.8, Examples and Exercises)

Recommended Books
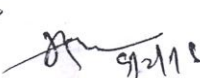
1- **Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi, fifteenth revised edition.**

2- **H.A. Taha, Operations Research - An introduction, Macmillan Publishing co. Inc. New york**
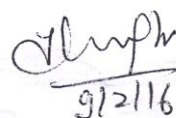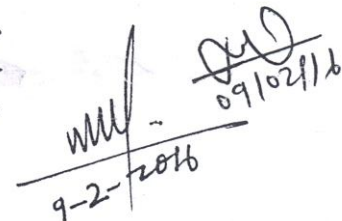
Reference Books

1. S.D, Sharma, Operation Research,

2. F.S, Hiller and G.J. Lieberman, Industrial Engineering Series, 1

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Analytic Number Theory-II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-V(3)

Unit I

Functional equation for the Riemann zeta function , Functional equation for the Hurwitz zeta function, Properties of Bernoulli numbers and Bernoulli polynomials.

(1. Chapter12 Section 12.8 to 12.12)

Unit II

Analytic proof of prime number theorem: A contour integral representation for $\dfrac{\psi_1(x)}{x^2}$,Upper bounds for $|\zeta(s)|$ and $|\zeta'(s)|$ near the line $\sigma = 1$.
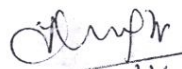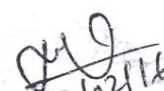
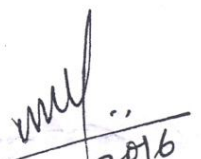(1. Chapter13 Section 13.1 to 13.4)

Unit III

The non-vanishing of $\zeta(s)$ on the line $\sigma = 1$, completion of the proof of the prime number theorem, Zero-free regions for $\zeta(s)$.

(1. Chapter13 Section 13.5 to 13.8)

Unit-IV

Geometric representation of partitions, Generating functions of partitions, Euler's pentagonal number theorem.

(1. Chapter 14 Section 14.1 to 14.5)

Unit V

Euler's recursion formula for p(n), Jacobi's triple product identity, The partition identity of Ramanujan.

(1. Chapter 14 Section 14.6 to 14.11)

*Exercise based on theory are expected to be solved.

Books Recommended:

1. **T.M. Apostol, Introduction to Analytic Number Theory, Narosa Pub.House, 1989.**

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Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: **Integral Transform – II**
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-V(4)

Unit I

Laplace wave Equations, Problems based on wave equations using Laplace Transform.
(1.chapter 5 (page 362 – 373))

Unit II

Electric Circuits, Applications to Beams, Problems based on it using Laplace Transform.
(1.chapter 5 (page 342 – 334))

Unit III

The Complex Fourier Transform, Inversion Formula, Fourier cosine and sine Transform.

(1.chapter 2 section I(page 174 – 208) excluding section 2.3 and convolution theorem)
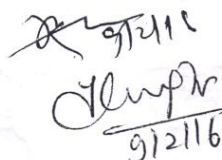
Unit IV

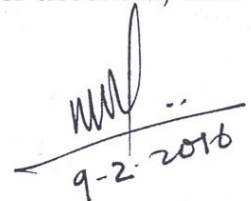Properties of Fourier Transforms, Convolution & Parseval's identity.

(1.chapter 2 section II(page 213 – 216) Theorem 9 (convolution theorem) and 2.3))
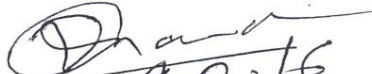
Unit V

Fourier Transform of the derivatives, Finite Fourier Sine & Cosine Transform, Inversion formula for Sine & Cosine Transform, Operational and combined properties of finite Sine & Cosine Fourier Transform. Application of infinite Fourier Transform)
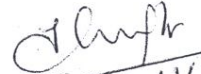
(1.chapter 2 section II(page 209) problem 8 – 26 (Page 222 – 240) , Chapter 6 problem 1-6 (page 375 – 380))
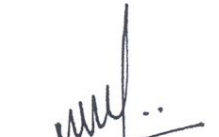
Books recommended:-
1. Integral Transform by Goyal & Gupta.

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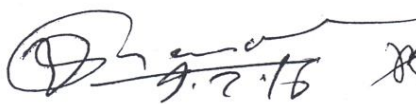|	
Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Fundamentals of Computer Science (Theory and Practical) –II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-VI(1)

Unit I

Data Structure: Analysis of Algorithms time and space requirements, Rate of growth, Standards Notations Big O, Θ (Theta), Ω (Sigma) , Array as an ADT, Stacks, Queues and Linked Lists, their Operations and Representations/implementations.
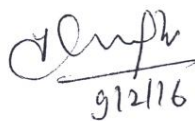
1. Chapter 1, Section 1.2 Chapter 2, Section 2.1,2.2,2.3.Chapter 4 section 4.1,4.2
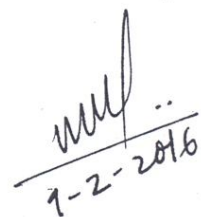2. Chapter 1 and sections (Exercise)

Unit II

Introduction to Trees and Binary Trees , Representation of general tree and Binary Tree, Sequential and Lists Representations of Binary tree, Binary search tree Implementations and evaluation, Extended ,Threaded and AVL Tree , B-Tree (concept only).
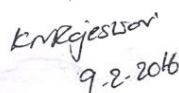
1. Chapter 5, Section 5.1,5.2,5.4,5.54 , Chapter 7 Section 7.2.
2. Chapter 8 and Sections

Unit III

Hashing – Open and Closed, Hash Function, sorting techniques, selection sort, Shell Sort, Quick Sort, Heap Sort, bubble sort and their analysis.

1. Chapter 7, Section 7.4
2 . Chapter 9 and Sections.

Unit IV

An Introduction to database System, Purpose and role of database system, Database Architecture. Database Users and Administrators. Structure of Relational Databases Database Schema, Keys, Schema Diagrams , Relational Query Languages , Relational Operations

Introduction to the Relational Model- Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus

3. Chapter 1 section 1.11-1.12, Chapter 2, 2.1-2.6 ,Chapter 6 Section 6.1 – 6.4.

Unit V

Introduction to SQL, Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries ,Additional Basic Operations, Set Operations ,Null Values ,Aggregate Functions ,Nested Subqueries , Modification of the Database.

Join Expressions , Views , Transactions ,Integrity Constraints , SQL Data Types and Schemas ,Authorization
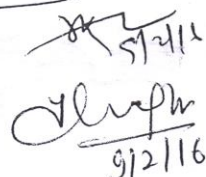
Relational Database design Normalization upto BCNF, Query Optimization strategies.

3. Chapter 3 Section 3.1 – 3.9, Chapter 4 Section 4.1-4.6, Chapter 8 Section 8.1,8.2,8.3 Chapter 13 Section 13.1
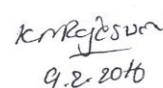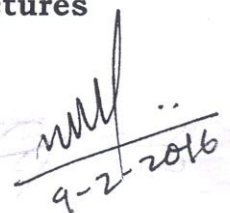
Text Book

1. **Data Structures Using C and C++, Yedidyah Langsam,Moshe J.,A.M. Tenenbaum, Pearson Eduction.**

2. **Yashwant Kanetkar, BPB publications Ltd. New Delhi, Ist Edition.**

3. **DATABASE SYSTEM CONCEPTS Abraham Silberschatz,Henry F. Korth, S. Sudarshan, Published by McGraw-Hill Sixth edition.**

4. **Robert L. Kruse, Bruce P. leung, Clovis L. Tondo, Data Structures and Program Design in C, Prentice- Hall Of India, New Delhi**

Department of Higher Education Govt. of M.P.

Semester wise syllabus for P.G.

As recommended by Central Board of Studies and

Approved by HE the Governor of M.P.

(Partially revised by the Board of Studies in Mathematics, DAVV, Indore on 09-02-2016 and to be effective from academic session 2016-2017)

Class	: M.Sc/ M.A. (Mathematics)
Semester	: IV
Title of subject/Group	: Integration Theory – II
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-VI(3)

Unit I

Outer Measure and Measurability.

(1, Chapter 12,Sec.1).

Unit II

Measure on algebra, Measure on semi-algebra, Extension theory of these measures.
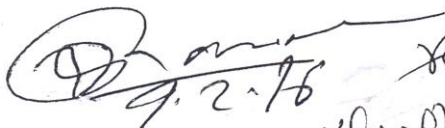
(1, Chapter 12,Sec.2).

Unit – III

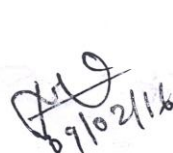Product Measures, Fubini's Theorem,Tonelli's Theorem, Examples to illustrate these theorems.
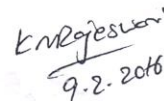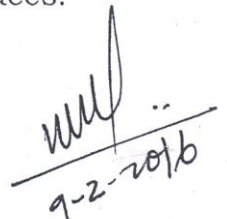
(1, Chapter 12,Sec.4).

Unit IV

Basic results on Locally compact Hausdorff Spaces, Baire Sets, Baire Measures,regularity of measures on locally compact Hausdorff Spaces.

(1, Chapter 13, Sec.1&2).

Unit V

Costruction of Borel Measures, Integration of continuous functions with compact support on locally compact spaces, Riesz-Markov Theorem.

(1, Chapter 13, Sec.3&4).

Note : Exercises based on the theory are expected to be solved .

Recommended Books:

1. **H.L.Royden, Real Analysis, Macmillan publishing co.Inc,New York,4th edition,1993.**

Reference Books:

1. P.R.Halmos,Measure Theory, Van Nostrand.

2. I.K.Rana, Introduction to Measure and Integration, Narosa Publishing House, New Delhi.

3. Ole A.Nielson, An Introduction to Integration and Measure Theory , Canadian Mathematical Society Series of Monographs and advanced Texts, Wiley-Interscience Publication.