Devi Ahilya University, Indore
Scheme of Examination – 2016-17
Class M.A./M.Sc. (Semester – III)
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
	Grand Total	500			

* Optionals presently being offered.

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

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

Unit I

Normed linear spaces , Banach Spaces and examples. Properties of Normed linear Spaces. Completeness proof of Banaches Spaces. Quotient spaces.

(1.Chapter 2 Sect 2.2, 2.3 & Exercises)

Unit II

Finite dimensional Normed spaces & subspaces, Equivalent norms, Compactness and Finite Dimension, Riesz Lemma, Linear Operators.

(1. Chapter 2 Sect 2.4, 2.5,2.6 & Exercises)

Unit III

Bounded and Continuous Linear Operators , Linear Functionals.

(1. Chapter 2 Sect 2.7,2.8 & Exercises)

Unit IV

Linear Operators and Functionals on and Finite Dimensional Spaces, Normed Spaces of Operators, Dual Space.

(1. Chapter 2 Sect 2.9, 2.10 & Exercises)

Unit V

Zorns Lemma , Hahn-Banach Theorem , Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces , Application to Bounded Linear Functionals on C[a,b].

(1.Chapter 4 Sect 4.1 to 4.4 & Exercises)

Text Books

1. E. Kreyszig Chapter 2 (2.1 to 2.10 & 4.1 to 4.4), 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	: III
Title of subject/Group	: Advanced Special functions-I
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-II(4)

Unit – I

The Gamma and Beta Functions : The Euler or Mascheroni constant γ, The Gamma function, A Series for $\Gamma'(z)/\Gamma(z)$, Evaluation of $\Gamma(1)$ and $\Gamma'(1)$, The Eular Product for $\Gamma(z)$, The Difference equation $\Gamma(z+1) = z\,\Gamma(z)$, The Beta function, the value of $\Gamma(z)\,\Gamma(1-z)$, the factorial function, Legendre's duplication formula, Gauss Multiplication theorem.

(3.Chapter 2 Page 19 - 41)

Unit –II

Hypergeometric functions : Hypergeometric functions, Integral Representation of F (a, b, c, z), Hypergeometric differential equation, Simple transformation, Quadratic transformation.

(3. Chapter 3 Page 42–72)

Unit –III

Generalized Hypergeometric functions : The function $_pF_q$, A differential equation, Contiguous function relations, a simple integral, Saalschutz theorem, Whipple's theorem, Dixon's theorem,Kummer's theorem,Ramanujan's theorem.

(3.Chapter 4 Page   73-106)

Unit –IV

Bessel Functions : Definition of $J_n(z)$,Bessel differential equation, Differential recurrence relations, pure recurrence relation, Generating function,Bassel's integral, Index half and n odd integer.
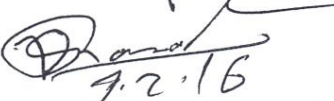
(3.Chapter 5 Page   107 ----156)
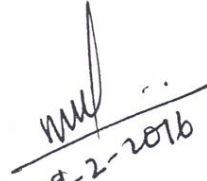
Unit –V

Legendre Polynomials: A generating function, Differential recurrence relations, pure recurrence relation, Legendre's differential equation, the rodrigues formula, Bateman's generating function, Additional generating functions, Hypergeometric forms of pn(x),Special properties of pn(x),More generating functions, Laplace's first integral form, Orthogonality.
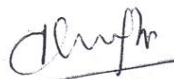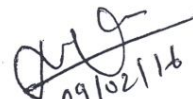
(3. Chapter 6 Page   157- 208)

Text Books

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.

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

Unit I

Spectral theory in normed linear spaces, basic concept concepts : regular value,resolvent, types of spectra(point, continuous and residual Spectra)and exercises explaining these concepts.

(1. Chapter 7 ,Sect 7.1,7.2).

Unit II

Spectral properties of Bounded Linear operators, Properties of Resolvent and spectrum, spectral mapping theorem for polynomials.

(1, Chapter 7, sect 7.3&7.4).

Unit III

Spectral radius of a bounded linear operator on a complex Banach space, Banach Algebras and their properties.

(1, Chapter 7, sect 7.5,7.6&7.7)

Unit IV

General properties of Compact linear operators

(1, Chapter 8, sect 8.1,8.2).

Unit V

Spectral properties of Compact linear operators on Normed Linear spaces (1, Chapter 8, sec.8.3,8.4)

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	: III
Title of subject/Group	: Advanced Numerical Analysis-I
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-III(3)

Unit – I

Introduction : Interpolation, Linear Interpolation and Higher Order Interpolation. Hermite Interpolation, Piecewise and Spline Interpolation, Piecewise quadratic Interpolation, Piecewise cubic interpolation, Piecewise cubic interpolation using Hermite Type Data, Quadratic Spline Interpolation, Cubic Spline Interpolation and its derivation, Problems .

(1.Chapter 4 section 4.1,4.5 and examples, section 4.6 and examples.)

Unit – II

Bivariate Interpolation : Lagranges and Newtons Bivariate Interpolation polynomials and their derivation, Approximation : Discrete and continuous data, Least Square Approximation.

(1. Chapter 4 section 4.7 and examples , section 4. 8 and examples, section 4.9 and examples.)

Unit – III

Orthogonal, Gram-Schmidt Orthogonalizing Process, Legendre and Chebyshev Polynomials.

(1.Chapter 4 section 4.9 definition 4.3 and 4.4 and subsections, examples.)

Unit- IV

Uniform Approximation, Uniform Polynomials Approximation (chebyshev), Chebyshev Polynomials Approximation and Lanczos Economization, Rational Approximation , Choice Of Methods.

(1.Chapter 4 section 4.10 and subsection, Examples, Section 4.11, Section 4.12, examples.)

Unit- V

Numierical Differentiation : Method Based On Interpolation, Non uniform and uniform nodal points, Quadratic Interpolation, Method based on Finite Difference Operators, Method based on Undetermined Coefficient, Optimum Choice Of Step Length.

(1.Chapter 5 section 5.2 and subsection, Examples, Section 5.3)

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	: III
Title of subject/Group	: OPERATIONS RESEARCH-I
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-IV(1)

Unit I

Operations Research - Introduction. Origin and Development of Operations Research, Nature and Features of Operations Research, Models in Operations Research, General Solution Methods for Operations Research, Phases of Operations Research, Uses and Limitations of Operations, Linear Programming Problems : Introduction Mathematical Formulation, Graphical Solution Method.

(1. Chapter 1 sect. 1.1 to 1.8, 1.10, Examples & Exercises, 1. Chapter 2 sect 2.1,2.2, 2.3, 2.4, Examples & Exercises ,1. Chapter 3 sect 3.1,3.2, Examples & Exercises)

(2. Chapter 1 sect 1.1,1.2,1.6, Chapter 2 sect 2.1,2.2)

Unit II

General Linear Programming Problem, Theory of Simplex method, Computational Procedure, Numerical problems, Solutions of simultaneous linear equations, inverse of a matrix using simplex method.

(1.Chapter 3 sect 3.3, 3.4, 3.5, Chapter 4 sect 4.1,4.2, 4.3, 4.6, 4.7, Examples & Exercises)

Unit III

Use of artificial variables, Big-M method, Two phase method, Problem of degeneracy and resolution of degeneracy, Applications of simplex method.
(1 Chapter 4 sect 4.4,4.5, 4.8 , Examples & Exercises)

Unit IV

Concept of duality : Introduction, General Primal-Dual pair, formulating a dual problem, primal-dual pair in matrix form, economic interpretation of duality, duality and simplex method, Fundamental Properties and Theorems of duality, complementary slackness, dual simplex method.
(1. Chapter 5 section 5.1, to 5.9, Examples and Exercises)

Unit V

Post optimality analysis, integer programming, revised simplex method.

(1. Chapter 6, Chapter 7: 7.1 to 7.4, Chapter 9: 9.1 to 9.2, 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, 1995.

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

Unit I

Characters of finite abelian groups,The character group, The orthogonality relations for characters, Dirichlet characters, Sums involving Dirichlet characters.

(1. Chapter 6, Section 6.4 to 6.10)

Unit II

Dirichlet characters, Sums involving Dirichlet characters, Dirichlet's theorem on primes in arithmetic progressions.

(1 Chapter 7, Section 7.1 to 7.8)

Unit III

The half-plane of absolute convergence of a Dirichlet series, the function defined by Dirichlet series, Euler products ,The half-plane of convergence of Dirichlet series

(1. Chapter 11, Section 11.1 to 11.6)

Unit IV

Analytic properties of Dirichlet series , Mean value formulas for Dirichlet series Integral formula for the coefficient of Dirichlet series, Integral formula for the partial sums of a Dirichlet series.

(1. Chapter11, Section 11.7 to 11.12)

Unit V

Properties of the gamma function, Integral representation of Hurwitz zeta functions, Analytic continuation of Hurwitz zeta functions, Hurwitz Formula.

(1. Chapter12, Section 12.1 to 12.7)

*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	: III
Title of subject/Group	: Integral Transform – I
Paper No.	: II/III/IV/V
Compulsory / Optional	: Optional Gr-V(4)

Unit I

Laplace Transform of the derivative of f(t), Laplace Transform of Integrals multiplication by t, Multiplication by t^n, Division by t use of Laplace transform to unit step function(Heaviside's unit functions) use of Laplace Transform to Bessel function ,Inverse Laplace Transform of derivatives, convolution, Heaviside's expansion theorem , problem depends on Convolution.

(1. Chapter 1 section I (page 7-57), section II (Page 58-114)

Unit II

Application of Laplace Transform to Solutions of ordinary Differential Equations With constant Coefficients.

(1. Chapter 1 section III (page 115 - 139) excluding problem 1,4,5 (page 116-120))

Unit III

Solution of Simultaneous ordinary Differential Equations by Laplace Transform. Solution of ordinary differential equations with variable coefficients by Laplace Transform.

(1. Chapter 1 section III (page 140-149) problems 23-28 including problem 1,4,5 (page 116-120))

Unit IV

Solutions of Partial differential Equations by Laplace transform Application of Laplace transform to integral equation.

(1. Chapter 1 section III (page 150 - 160), section IV (Page 161-173)

Unit V

Heat conduction equations. Problems based on Heat conduction equation using Laplace transform.

(1. Chapter V (page 354 -361) including problems dependent on it on exercise page 371)

Books recommended:-
1. Integral Transform by Goyal & Gupta.

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

Unit I

Introduction to Object Oriented Programming in C++, Need of Object-Oriented Programming , Characteristics of Object-Oriented Languages, Class, Object and Scopes, Nested Classes.

1.Chapter 1 and sections, Chapter 6 and sections.

Unit II

Pointer class member , class initialization , constructor and destructor , assignment and distribution, Virtual Functions and Friend Functions

1.Chapter 6 and sections, Chapter 11 and sections.

Unit III

Overloading : Function and Operators, Templates , Types of Templates and class templates.
1.Chapter 8 and sections, Chapter 14 and sections.

Unit IV

Class Inheritance and their Types, Multiple and Virtual Inheritance.

1.Chapter 9 and sections.

Unit V

Operating System: Introduction, What Operating Systems Do, Computer-System Organization, Computer-System Architecture , Operating-System architecture, Operating-System Operations, Process Management, Memory Management ,Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems , Client-Server Computing , Peer to Peer Computing, Open-Source Operating Systems . (Only Basic Concept of these all.)

2. Chapter 1 section 1.1 to 1.13

Text Books

1. **Robert Lafore Object Oriented Programming in C++, Forth edition, Sams Publishing Indianapolis, IN 46290 USA**

2. **Abraham Silberschatz, Peter Baer Galvin, Greg Gagne , Operating System Concept Wiley India Pvt. Ltd, Eights edition**

References :

1. S.B. LIPMAN, , J. LAJOI, C++ PRIMER,ADDISON

2. B.Stroustruo, The c++ programming languages, Addison – Westey.

3. Andrew S Tanenbaum, Modern Operating System, Pearson International, Third edition.

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

Unit I

General Measures: Examples and Properties, Semi-finite & sigma finite measures.

(1, Chapter 11, Sect.1)

Unit II

Completion of a measure and measurable functions.

(1, Chapter 11 ,relevant parts of Sec.1 & Sec.2).

Unit III

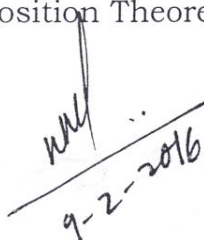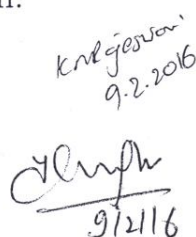Integration of Measurable functions

(1, Chapter 11,Sec.3).

Unit IV

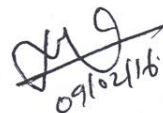Signed Measures, Hahn decomposition Theorem, Mutually singular measures, Jordan decomposition Theorem.

(1, Chapter 11,Sec.5).

Unit V

Radon Nykodym Theorem, Lebesgue decomposition Theorem

(1, Chapter 11,Sec.6).

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.