



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Syllabus for

M.Sc

(Mathematics)



Syllabus for

M.Sc I Semester Examination 2016-17

Mathematics

FIRST SEMESTER

1. Course Code : _____
2. Course Name : **M.Sc. Mathematics**
3. Total Paper : **7**
4. Compulsory Paper : **4**
5. Optional Paper : **1**

Sub Code.	Subject Name	Theory										Practical		Total	
		Paper					CCE		Total Marks						
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max	Min	Max
Compulsory Paper															
	I	Advanced Abstract Algebra –I	80	0	0	80	28	20	7	100	35	0	0	100	35
	II	Real Analysis	80	0	0	80	28	20	7	100	35	0	0	100	35
	III	Topology-I	80	0	0	80	28	20	7	100	35	0	0	100	35
	IV	Complex Analysis-I	80	0	0	80	28	20	7	100	35	0	0	100	35
Optional select any one															
	V(I)	Advanced Discrete Mathematics-I	80	0	0	80	28	20	7	100	35	0	0	100	35
	V(II)	Differential and integral Equations-I	80	0	0	80	28	20	7	100	35	0	0	100	35
	V(III)	Fundamentals of computers (Theory and Practical)	60	0	0	60	21	20	7	80	28	20	7	100	35
	V(IV)	Advanced Numerical Analysis -I	80	0	0	80	28	20	7	100	35	0	0	100	35



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics
Paper Title	-	Advanced Abstract Algebra –I
Paper	-	I

Max. Marks : 80

Unit-1 Normal & Subnormal series of groups, Composition series, Jordan Holder series.

Unit-2 Solvable & Nilpotent groups.

Unit-3 Extension fields. Roots of polynomials, Algebraic and transcendental extensions. Splitting fields. Separable and inseparable extension.

Unit-4 Perfect fields, Finite fields, Algebraically closed fields.

Unit-7 Automorphism of extension, Galois extension. Fundamental theorem of Galois theory Solution of polynomial equations by radicals, Insolubility of general equation of degree 7 by radicals.

Text books :-

- (1) I.N. Herstein, Topics in Algebra, ,Wiley Eastern, New Delhi.
- (2) V.Sahai & V. Bisht, Algebra, Narosa Publishing House.
- (3) P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University press.

Reference Books :-

- (1) N. Jacobson, Basic Algebra, Vol. I, II & VIII, Hindustan Publishing Company.
 - (2) S. Lang, Algebra, Addison- Wesley.
 - (3) I.S. Luther & I.B.S. Passi Algebra vol-1,2,3 Narosa company.
- Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics
Paper Title	-	Real Analysis
Paper	-	II

Max. Marks : 80

- Unit-I** Definition and existence of Riemann- Stieltjes integral and its properties, Integration and differentiation.
- Unit-II** Integration of vector- valued functions, Rectifiable curves. Rearrangements of terms of a series. Riemann's theorem.
- Unit-III** Sequences and series of functions, Point wise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation.
- Unit-IV** Functions of several variables, linear transformations, Derivatives in an open subset of R^n , Chain rule, Partial derivatives, Differentiation, Inverse function theorem.
- Unit-V** Derivatives of higher order, Power series, uniqueness theorem for power series, Abel's and Tauber's theorems, Implicit function theorem,

Text books :

1. Walter Rudin, Principles of Mathematical Analysis, McGraw Hill.

Reference books:

1. T.M. Apostol, Mathematical Analysis Narosa.
2. H.L. Royden, Real Analysis, Macmillan (Indian Edition)
3. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics
Paper Title	-	Topology-I
Paper	-	III

Max. Marks : 80

Unit – I Countable and uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem, statements of Cantor's theorem and the Continuum hypothesis. Zorn's lemma. well- ordering theorem. [G.F. Simmons and K.D. Joshi]

Unit- II Definition and examples of topological spaces. Closed sets. Closure. Dense subsets. Neighbourhoods, interior exterior and boundary. Accumulation points *and* derived sets. Bases and sub-bases, Subspaces and relative topology. [G.F. Simmons]

Unit-III Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism. [G.F. Simmons, K.D. Joshi, J.R. Munkers]

Unit- IV First and Second Countable spaces. Lindelof's theorems. Separable spaces. Second Countability and Separability. [G.F., Simmons]

Unit- V Path-connectedness, connected spaces. Connectedness on Real line. Components, Locally connected spaces. [J.R. Munkers]

Text Books:-

1. J.R. Munkers, Topology-A first course, Prentice-Hall of India.
2. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill
3. K.D. Joshi: Introduction to General Topology, Wiley Eastern.

Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics Paper
Title	-	Complex Analysis-I
Paper	-	IV

Max. Marks : 80

Unit-I Complex integration, Cauchy – Goursat theorem, Cauchy integral formula, Higher order derivatives

Unit-II Morera's theorem. Cauchy's inequality. Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem.

Unit-III The maximum modulus principle. Schwartz lemma. Laurent series. Isolated singularities. Meromorphic functions, The argument principle. Rouché's theorem. Inverse function theorem.

Unit – IV Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\arg z, \log z, z^a$.

Unit – V Bilinear transformations, their properties and classification. Definitions and examples of conformal mappings.

Text Book :

1. J.B. Conway, Functions of one complex variable, Springer-verlag

Reference Books:

1. S. Ponnuswamy, Foundations of complex analysis, Narosa Publishing House.
2. L.V. Ahlfors, Complex analysis, McGraw Hill
3. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics
Paper Title	-	Advanced Discrete Mathematics-I
Paper	-	V (optional-I)

Max. Marks : 80

Unit-I Semigroups and monoids, subsemigroups and submonoids, Homomorphism of semigroups and monoids, Congruence relation and Quotient semigroups, Direct products, Basic Homomorphism Theorem.

Unit-II Lattices- Lattices as partially ordered sets, their properties, Lattices as Algebraic systems, sublattices, Bounded lattices, Distributive Lattices, Complemented lattices.

Unit-III Boolean Algebra- Boolean Algebras as lattices, various Boolean identities. Joint irreducible elements, minterms, maxterms, minterm Boolean forms, canonical forms, minimization of Boolean functions. Applications of Boolean Algebra to switching theory (Using AND, OR, & NOT gates) the Karnaugh method.

Unit-IV Graph Theory- Definition and types of graphs. Paths & circuits. Connected graphs. Euler graphs, weighted graphs (undirected) Dijkstra's Algorithm. Trees, Properties of trees, Rooted & Binary trees, spanning trees, minimal spanning tree.

Unit-V Complete Bipartite graphs, Cut-sets, properties of cut sets, Fundamental Cut-sets & circuits, Connectivity and Separability, Planar graphs, Kuratowski's two graphs, Euler's formula for planar graphs.

Text Books :-

1. J.P. Tremblay & R. Manohar, Discrete Mathematical structures, McGraw Hill.
2. N. Deo. : Graph theory with applications Prentice hall.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Reference Books:-

1. C.L. Liu : Elements of Discrete Mathematics McGraw Hill.
2. Seymour Lipschutz/More lipson : Discrete Mathematics, McGraw Hill.
3. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class - **M.Sc**
Semester - **I**
Subject - **Mathematics**
Paper Title - **Differential and Integral**
Equations-I Paper No. - **V (Optional-II)**

Max. Marks : 80

Unit-I Linear differential equation of second order, ordinary simultaneous differential equations [As given in Sharma and Gupta].

Unit-II Total differential equations, Picard Iteration Methods, Existence and uniqueness theorem [As given in Sharma and Gupta].

Unit-III Systems of first order equations, Existence and Uniqueness theorem. [As given in Deo, Lakshmikantham and Raghvendra].

Unit-IV Solution of non homogeneous voltera integral equation of second kind by method of successive substitution and also method of successive approximation. Determination of some resolvent kernels. Voltera integral equation of first kind. [As given in Shanti Swarup].

Unit-V Solution of the Fredholm integral equation by the method of successive substitution and also the successive approximation, Iterated Kernels and reciprocal functions. [As given in Shanti Swarup]

Recommended Text Book :-

1. S.G. Deo. V. Lakshmiknatham and V. Raghavendra,
Textbook of Ordinary Differential Equations 2nd Edition,
TMH, 1997.
2. J.N. Sharma & R.K. Gupta Differential Equation.
Krishna Prakashan Mandir
3. Shanti Swarup, Integral Equation, Krishna Prakashan
Mandir, Meerut.

References :-



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

1. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, TMH, 1972.
2. Ahmad Shair and Rao, Theory of Ordinary Differential Equations with application in Biology and Engineering, East- West Press, 1999.
3. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class - **M.Sc**
Semester - **I**
Subject - **Mathematics**
Paper Title - **Fundamentals of Computers Paper No. - V**
(optional-III)

Max. Marks : 60 **Practical : 27**

Unit-I Characteristics of Computers, Block Diagram of Computer, Generation of Computers, Classification of Computers, Memory and Types of Memory, Hardware & Software, System Software, Application software. Compiler, Interpreter, Programming Languages, Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Algorithm and Flowchart. Number system.

Unit-II Introduction to MS-DOS History and version of DOS, internal and external DOS command, creating and executing batch file, booting process, Disk, Drive Name, FAT, File and Directory Structure and Naming Rules, Booting Process, DOS System Files, DOS Commands; Internal- DIR, MD, RD, COPY, COPY CON, DEL, REN VOL, DATE, TIME, CLS, PATH, TYPE, VER etc. External CHKDSK, XCOPY, PRINT, DISKCOPY, DOSKEY, TREE, MOVE, LABEL, FORMAT.

Unit-III Introduction for windows System, WINDOWS XP : Introduction to Windows XP and its Features. Hardware Requirements of Windows. Windows Concepts, Windows Structure, Desktop, Taskbar, Start Menu, My Pictures, My Music- Restoring a deleted file, Emptying the Recycle Bin. Managing Files, Folders and Disk-Navigating between Folders, Manipulating Files and Folders, Creating New Folder, Searching Files and Folders.

Unit-IV MS Word : Introduction to MS Office, Introduction to MS Word, Features & area of use. Working with MS Word, Menus & Commands, Toolbars & Buttons, Shortcut Menus, Wizards &



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Templates, Creating a new Document, Different Page Views and Layouts, Applying various Text Enhancements.

Unit-V **MS Excel** : Introduction and area of use, working with MS Excel, Toolbars, Menus and Keyboard Shortcuts, Concepts of Workbook & worksheets, Using different features with Data, Cell and Texts, Inserting, Removing & Resizing of Columns & Rows.
MS PowerPoint : Introduction & area of use, Working with MS PowerPoint, Creating a New Presentation, working with presentation, Using Wizards : Slides & its different views, Inserting, Deleting and Copying of Slides.

Reference Book :-

1. Computer Fundamentals by P.K. Sinha.
2. Microsoft Office : Rom Mansfield
3. Books prescribed in unified syllabus.

Practical list:-

Max. Marks- 27

1. Create directory using MS DOS
2. Create folder in MS windows
3. Write steps to send mail merge
4. Create document and use wizards & Templates.
5. Create a workbook and use different formula.
6. Create PPT presentation using MS power point.
7. Create PPT presentation using Wizards
8. Create a document and insert header and footer, page title using MS-Word
9. Use MS-WORD to insert a table in document.
10. Use built in function find sum, average, minimum, maximum, count for given data.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	I
Subject	-	Mathematics
Paper Title	-	Advanced Numerical Analysis-I
Paper No.	-	V (Optional-IV)

Max. Marks : 80

Unit-I Transcendental and Polynomial Equations Bisection Method, Iteration methods based on First & Second degree equation Rate of convergence.

Unit-II General iteration methods, System of Non-linear equations, Method for complex roots, Polynomial equation, Choice of an iterative method and implementation.

Unit-III System of linear algebraic equations and Eigen value problems, Direct method, Iteration methods, Eigen values and Eigen Vectors, Bounds on Eigen values, Jacobi Givens Household's symmetric matrices. Rutishauser method for arbitrary matrices, Power method, inverse power methods.

Unit-IV Interpolation – Introduction, Lagrange and Newton interpolation, Finite difference operators, Interpolating Polynomials using Finite Differences, Hermite interpolation.

Unit-V Piecewise and spline interpolation, Bivariate interpolation approximation least squares approximation. Uniform approximation, rational approximation. Choice of the method.

Text books :-

- Numerical methods for scientific and engineering computation.
- M.K. Jain, S.R.K. Iyengar, R.K. Jain.
- Books prescribed in unified syllabus.

Note :- Use of Scientific calculator in allowed in examination.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Syllabus for

M.Sc. II Semester Examination

Mathematics

SECOND SEMESTER

- 1. Course Code : _____
- 2. Course Name : **M.Sc.**

(Mathematics)

- 3. Total Paper : **7**
- 4. Compulsory Paper : **4**
- 7. Optional Paper : **1**

Sub Code.	Subject Name	Theory										Practical		Total	
		Paper					CCE		Total Marks						
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max	Min	Max	Min	
Compulsory Paper															
411	I	Advanced Abstract Algebra –II	80	0	0	80	28	20	7	100	35	0	0	100	35
412	II	Lebesgue Measure and Integration-II	80	0	0	80	28	20	7	100	35	0	0	100	35
413	II	Topology-II	80	0	0	80	28	20	7	100	35	0	0	100	35
414	IV	Complex Analysis-II	80	0	0	80	28	20	7	100	35	0	0	100	35
Optional select any one															
1	V(I)	Advanced Discrete Mathematics-II	80	0	0	80	28	20	7	100	35	0	0	100	35
2	V(II)	Differential and integral Equations-II	80	0	0	80	28	20	7	100	35	0	0	100	35
3	V(III)	Programming in “C” (Theory and Practical)	60	0	0	60	21	20	7	80	28	20	7	100	35
4	V(IV)	Advanced Numerical Analysis-II	80	0	0	80	28	20	7	100	35	0	0	100	35



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	II
Subject	-	Mathematics
Paper Title	-	Advanced Abstract Algebra-II
Paper	-	I

Max. Marks : 80

Unit-1 Introduction to Modules, examples, submodules, quotient modules, Module homomorphism, isomorphism, Finitely generated modules, cyclic modules.

Unit-2 Simple modules, Semisimple modules, Free modules, Schur's lemma.

Unit-3 Noetherian & Artinian modules and rings, Hilbert basis theorem. Wedderburn -Artin theorem.

Unit-4 Uniform modules, Primary modules, Noether-Laskar theorem, Fundamental structure theorem of modules over a principal ideal domain.

Unit-7 Algebra of Linear Transformation, characteristic roots, Matrices, Matrix of Linear Transformations, similarity of Linear transformation, Invariant spaces, Reduction to triangular forms.

Text book :

- (1) P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press, (Indian Edition)
- (2) I.N. Herstein, Topics in Algebra, Wiley Eastern.
- (3) S. Kumaresan, Linear Algebra-A geometric approach, Prentice Hall India Ltd.
- (4) Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	II
Subject	-	Mathematics
Paper Title	-	Lebesgue Measure & Integration
Paper	-	II

Max. Marks : 80

Unit -I Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.

Unit - II Integration of Non-negative functions. The General integral. Integration of Series, Reimann and Lebesgue Integrals.

Unit - III The Four derivatives. Functions of Bounded variation. Lebesgue Differentiation Theorem, Differentiation and Integration.

Unit - IV The L^p -spaces, Convex functions, Jensen's inequality. Holder and Minkowski inequalities. Completeness of L^p .

Unit - V Dual of space when $1 < p < \infty$, convergence in measure, Uniform. Convergence and almost uniform convergence.

Text book :

1. G. de Barra. Measure Theory and Integration, Wiley Eastern (Indian Edition)

References Books:

1. Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill, International student edition,
2. H.L. Royden, Real Analysis, Macmillan, Indian Edition.
3. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	II
Subject	-	Mathematics
Paper Title	-	Topology II
Paper	-	III

Max. Marks : 80

Unit – I Separation Axioms T_0 , T_1 , T_2 , T_3 , T_4 Their Characterizations and basic properties, Urysohn's lemma. Tietze Extension Theorem. [K.D. Joshi, G.F. Simmons]

Unit – II Compactness. Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets, Local compactness. [G.F. Simmons]

Unit –III Tychon Off product topology in terms of standard sub-base and its characterizations. Projection maps. Separation axioms and product spaces, Connectedness and product spaces, Compactness and product spaces (Tychonoff's theorem) Countability and product spaces. [G.F. Simmons]

Unit – IV Net and filter's Topology and convergence of nets, Hausdorffness and nets, Compactness and nets. Filters and their convergence, Canonical way of converting nets to filters and vice-versa. Ultrafilters and Compactness. [K.D. Joshi]

Unit –V The fundamental group and covering spaces-Homotopy of paths, The fundamental group, Covering spaces, The fundamental group of the circle and the fundamental theorem of Algebra. [J.R. Munkers]

Text books :-

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.
2. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company.
3. K.D. Joshi, Introduction to general topology Wiley Eastern Ltd.
4. Books prescribed in unified syllabus.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc/MA
Semester	-	II
Subject	-	Mathematics
Paper Title	-	Complex Analysis II
Paper	-	IV

Max. Marks : 80

Unit – I Weierstrass factorization theorem. Gamma and its properties. Riemann Zeta function. Riemann’s functional equation

Unit – II Mittag-Leffler’s theorem. Analytic continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation.

Unit – III Schwartz reflection principle. Harmonic function on a disc. Harnax inequality and theorem. Dirichlet problem. Green’s function.

Unit-IV Canonical products. Jensen’s formula. Hadamard’s three circles theorem. Order of an entire function. Exponent of convergence. Borel’s theorem Hadamard’s factorization theorem.

Unit-V The range of an analytic function. Bloch’s theorem. The little Picard theorem. Schottky’s theorem. Montel Caratheodary and great Picard theorem. Univalent function. Bieberbach conjecture and the $\frac{1}{4}$ - theorem.

Text Book.:-

1. J.B. Conway ,Functions of one complex variable, Springer-Verlag

Reference

1. S Ponnuswamy, Fundamentals of complex analysis, Narosa Publishing House.
2. L.V. Ahlfors, Complex Analysis, McGraw Hill



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	-	M.Sc
Semester	-	II
Subject	-	Mathematics
Paper Title	-	Advanced Discrete Mathematics II
Paper	-	V (Optional-I)

Max. Marks : 80

Unit-I Matrix representation of graphs- Incidence matrix, Cut set matrix, Path Matrix, Circuit Matrix and Adjacency matrix. Directed graphs Definition of types of directed graphs, Binary search trees.

Unit-II Discrete Numeric functions, Asymptotic Behaviour of Numeric functions, Generating functions. Recurrence Relations- Linear Recurrence Relations with constant coefficients, Homogeneous solutions, particular solutions, Total Solutions.

Unit-III Computability and Formal languages- Languages, Phrase structure grammars, Derivation, Sentential forms, Language generated by grammar. Regular, context-free and context sensitive grammars.

Unit-IV Finite State Automata, Diagram & Language determined by an Automaton, Finite State Acceptors, Deterministic and Non-deterministic Finite Automata. Finite State Machines, their transition tables & diagrams. Equivalent machines.

Unit-V Reduced Machines, Kleen's theorem (Statement only) Pumping lemma, Moore and Mealy Machines, Turing Machines. Regular Expressions and corresponding regular languages (Def only)

Text Books :-

1. J.P. Tremblay & R. Manohar; Discrete Mathematical Structures, McGraw Hill.
2. N. Deo. Graph theory with applications, Prentice Hall.

References :-



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

1. C.L. Liu : Elements of Discrete Mathematics McGraw Hill.
2. Semyour Lipschutz/Marc Lipson Discrete Mathematics, McGraw Hill.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **II**
Subject : **Mathematics**
Paper Title : **Differential and Integral Equations-II Optional:
V (Optional-II)**

Max. Marks : 80

Unit-I Partial differential equation of the first order Lagrange's method and Charpits method [As given in Sharma and Gupta]

Unit-II Homogeneous Linear Equations with variable coefficients, Partial differential equation of the second order- Monge's methods [As given in Sharma and Gupta]

Unit-III Fundamental Matrix and Non Homogeneous linear systems. [As given in Deo, Lakshmikanthan and Raghvendra]

Unit-IV Linear systems with constant and periodic coefficients, Floquet's theory [As given in Deo, Lakshmikanthan and Raghvendra]

Unit-V Unique solution of the non-homogeneous Fredholm integral equation, order of the pole of Fredholm function, conjugate complex, eigen value of the Kernel, Hadamard's theorem, Fundamental functions, Degenerate Kernel. [As given in Shanti Swarup].



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Recommended Text Book :-

1. S.G. Deo. V. Lakshmikanthan and V. Raghvendra, Textbook of Ordinary Differential Equations 2nd Edition, TMH, 1997.
2. J.N. Sharma & R.K. Gupta Differential Equation. Krishna Prakashan Mandir, Meerut.
3. Shanti Swarup, Integral Equation, Krishna Prakashan Mandir, Meerut.

References:-

1. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, TMH, 1972.
2. Ahmad Shair and Rao, Theory of Ordinary Differential Equations with application in Biology and Engineering, East-West Press, 1999.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **II**
Subject : **Mathematics**
Paper Title : **Programming in C**
Optional : **V (Optional-III)**

Theory Marks : 60

Practical : 27

Unit-I Programming Languages- Low-level Language, Assembly Language, Middle Level Language and High level Language, Compiler, Interpreter, Assembler, Difference between Compiler, Interpreter and Assembler. Program Logic development using algorithm and flowchart, Historical development of 'C'. Introduction to C programming structure, compiler and IDE (integrated development environment)

Unit-II Constants, variables and keywords, 'C' instructions. Data representation: Simple data types like real, integer, character, etc. Program statements and header files, use of input and output statements in running simple C programs.

Unit-III Operators : Arithmetic, Assignment, relational, Logical, Increment and Decrement, Bitwise and Boolean Operator precedence, arithmetic and logical expressions evolution. Decision control : 'if' statement, 'if-else' statement, nested if and conditional operators. Development of 'C' programs using constructs mentioned in the unit.

Unit-IV Case control structures :- switch statement, go to statement, Loop Control Structures :- for loop while loop and do-while loop, Break statement, continue statement. Development of 'C' programs using the control structures.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Unit-V Arrays :- One dimension array, 2D array, 3D array, Development of 'C' programs using one dimensional arrays and 2D arrays, structure and union.

Reference Books :-

1. Samuel P. Harkison and Gly L Steele Jr. C; A Reference manual 2nd Edition Prentice hall 1984.
2. Brain W. Kernigham & Dennis M. Ritchie the C programmed Language 2nd Edition (ANSI features). Prentice Hall 1989.

Practical :-

Max. Marks- 27

1. Program to find roots of quadratic equation.
2. Program to rules x to the Power N.
3. Program to add digits of a number.
4. Program to check whether a number is prime or not prime.
5. Program to print given number in reserve order.
6. Program to print GCD of two numbers.
7. Program to generate Fibonacci series.
8. Program for reversing an array using function.
9. Program to calculate factorial of a given number.
10. Program to find the sum of first n natural numbers.
11. Program for linear search.
12. Program for library search.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **II**
Subject : **Mathematics**
Paper Title : **Advanced Numerical Analysis -II**
Optional Gr. : **V (Optional –IV)**

Max. Marks : 80

Unit-I Differentiation : Introduction, Numerical Differentiation, Optimum choice of step-length, Extrapolation methods. Partial Differentiation.

Unit-II Integration: Numerical integration, Methods based on interpolation, methods based on undetermined coefficients, Composite integration methods Romberg and Double integration.

Unit-III Ordinary differential equations initial value problems. Introduction, Difference equations, numerical and single step methods, stability analysis of single step methods, Stability Analysis of Single step Methods. Multistep methods, Predictor- Corrector methods. Stability analysis of multistep methods, stiff system.

Unit-IV Ordinary differential equations Initial value Problem method (Shooting method)

Unit-V Finite difference methods, Finite element methods.

Text book :-

Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K. Iyengar, R.K. Jain.

Note :- Use of Scientific calculator is allowed in examination.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

**Syllabus for
M.Sc. III Semester Examination 2016-17
Mathematics
THIRD SEMESTER**

1. Course Code : _____
2. Course Name : **M.Sc.
Mathematics**
3. Total Paper : **07**
4. Compulsory Paper : **01**
7. Optional Paper : **04**
6. Practical : **Y**

Paper code	Subject Name	Theory										Practical		Total	
		Paper					CCE		Total Marks			Max.	Min.	Max.	Min.
		1 st	2 nd	3 rd	Max.	Min.	Max.	Min.	Max.	Min.					
Compulsory Paper															
	Functional Analysis-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
Optional paper select any four															
I	Partial differential Equations-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
II	Algebraic topology-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
III	Advanced Graph Theory -I	80	0	0	80	28	20	7	100	35	0	0	100	35	
IV	Advanced special function-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
V	Theory of linear operators-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
VI	Mechanics -I	80	0	0	80	28	20	7	100	35	0	0	100	35	
VII	Fuzzy sets and their applications-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
VIII	Operations research -I	80	0	0	80	28	20	7	100	35	0	0	100	35	
IX	Wavelets	80	0	0	80	28	20	7	100	35	0	0	100	35	
X	Integral Transform -I	80	0	0	80	28	20	7	100	35	0	0	100	35	
XI	Advanced Programming in 'C' Theory & Practical-I	60	0	0	60	21	20	7	80	28	20	7	100	35	
XII	Integration Theory-I	80	0	0	80	28	20	7	100	35	0	0	100	35	
XIII	Spherical Trigonometry and Astronomy-I	80	0	0	80	28	20	7	100	35	0	0	100	35	



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper : **Compulsory**
Paper Title : **Functional Analysis-I**

Max. Marks : 80

Unit-I Normed linear spaces. Banach Spaces and examples. Properties of normed linear spaces, Basic properties of finite dimensional normed linear spaces.

Unit-II Normed linear subspace, equivalent norms, Riesz lemma and compactness. Quotient space of normed linear spaces and its completeness.

Unit-III Linear operator, Bounded linear operator and continuous operators.

Unit-IV Linear functional, bounded linear functional, Dual spaces with examples.

Unit-V Hilbert space, orthogonal complements, orthonormal sets and sequences. Representation of functional on Hilbert spaces.

Text Books :

1. E. Kreyszig, Introductory functional analysis with application, Jhon Wiley & sons. New York 1978.
2. G.F. Simmons, Introduction to Topology & Modern Analysis, Tata Mc Graw Hill, New York.

Reference :-

1. B. Choudhary and Sudarshan Nanda, Functional Analysis with applications, Wiley Eastern Ltd.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Partial Differential Equation-I**
Optional Gr. : **Optional I**

Max. Marks : 80

Unit-I Derivation of Laplace equation, derivation of Poisson's equation, boundary value problems (BVPs), properties of harmonic function: the spherical mean, mean value theorem for harmonic function. Maximum-minimum principle and consequences.

Unit-II Separation of variables, solution of Laplace equation in cylindrical coordinates, solution of Laplace equation in spherical coordinates, parabolic differential equation occurrence of the diffusion equation, boundary conditions.

Unit-III Elementary solution of diffusion equation, Dirac delta function, separation of variables method, Solution of diffusion equation in cylindrical coordinates, solution of diffusion equation in spherical coordinates.

Unit-IV Maximum and minimum principle and consequence, Hyperbolic Differential equation : Occurrence of the Wave Equation, Derivation of One Dimensional Wave Equation, Solution of One dimensional Wave Equation by Canonical Reduction, The Initial Value Problem : D'Alembert's solution.

Unit-V Vibrating string-variables Separable solution, Forced Vibrations- solution of nonhomogeneous equation, boundary and initial value problems for two dimensional wave equation-method of Eigen function, periodic solution of one-dimensional wave equation in cylindrical coordinates, periodic solution of one-dimensional wave equation in spherical polar coordinates.

Text Books :-



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

K. Sankara Rao, Introduction to partial differential equations (2003)

Reference Books :-

L.C. Evans, partial differential equations (1998)



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Algebraic Topology-I**
Paper : **Optional - II**

Max. Marks : 80

Unit-I Retractions and fixed point. Brouwer's fixed point for Disc. (Art-77).

Unit-II Deformation retracts and homotopy type (Art78)

Unit-III Fundamental group of ' s^n ' and fig 8 and torus (Art 79 & Art 60)

Unit-IV Jordan separation theory, nul homotopy lemma, homotopy extension lemma. Borsuk lemma. Invariance of domain Art. 61 and 62.

Unit-V The Jordan curve theorem. A non separation theorem. (Art 63) and Imbedding graphs in the plane, Theta space (Art 64)

Book Recommended :-

1. J.R. Munkers, Topology, Second edition, Prentice Hall of India, 2000.

Reference Book :-

1. J.R. Munkers, Elements of Algebraic Topology, Addison-Wesley Publishing Company, 1984.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Advanced Graph Theory – I Paper**
: **Optional -III**

Max. Marks : 80

Unit-I Revision of graph theoretic preliminaries. Isomorphism of graphs, subgraphs.

Unit-II Walks, Paths and circuits, Connected graphs, Disconnected graphs and components, Euler Graphs, Operations on Graphs, Hamiltonian paths and circuits, The traveling salesman problem.

Unit-III Trees, Properties of trees, Distance and centers in a tree, Rooted and Binary trees, Spanning trees, Fundamental circuits, spanning trees in a weighted graph.

Unit-IV Cut-sets, Properties of a cut-set, Fundamental circuits and cut-sets, connectivity and separability.

Unit-V Planar graphs, Kuratowski's two graphs, Different Representations of a planer graph, Detection of Planarity, Geometric Dual, Combinational Dual.

Text Book :-

Graph theory with applications to Engineering and Computer Science by Narsingh Deo. Prentice Hall of India.

Reference books :-

Graph theory by Harary.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Advanced Special Function-I Paper**
: **Optional - IV**

Max. Marks : 80

Unit-I Gamma and Beta Function: The Euler or Macheroni Constant γ , Gamma Function
A series for $\Gamma'(z)/\Gamma(z)$, Difference equation $\Gamma(z+1) = z\Gamma(z)$

$z\Gamma(z)$, value of $\Gamma(1-z)$, Factorial function, Legendre's duplication formula,
Gauss multiplication theorem.

Unit-II Hypergeometric function and function ${}_2F_1(a,b;c;z)$. A simple integral form
valuation of ${}_2F_1(a,b;c;z)$. Contiguous function relations, Hyper geometric
differential equation and its solutions, $F(a,b;c;z)$ as function of its
parameters.

Unit-III Generalized Hypergeometric function.

Unit-IV Elementary series manipulations, Simple transformation,
Relations between functions of z and $1-z$.

Unit-V confluent hyper geometric function and its properties.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Books Recommended :-

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.
4. The saxena V.P.- I-Function, anamaya- New Delhi, 2008.

Reference Books :-

1. Lebedev, N.N., Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New Jersey, USA 1997.
2. Whittaker, E.T. and Watson, G.N., A course of Modern Analysis Cambridge University Press, London, 1963.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Theory of Linear Operators-I Paper**
: **Optional -V**

Max. Marks : 80

Unit-I Spectral Theory in finite dimensional normed spaces.
Regular value resolvent set and spectrum.

Unit-II Spectral Properties of Bounded Linear Operators, resolvent and spectral mapping theorem for polynomials.

Unit-III Spectral radius of a bounded linear operator on a complex Banach space.
Banach Algebra, Further properties of Banach Algebras.

Unit-IV Compact linear operators on normed spaces, further properties of compact linear operators.

Unit-V Spectral properties of compact linear operators.

Text Books :

1. E. Kreyszig, Introductory functional analysis with application, John Wiley & sons. New York 1978.
2. G.F. Simmons, Introduction to Topology & Modern Analysis, Tata McGraw Hill, New York.

Reference :-

1. P.R. Halmos, Introduction to Hilbert space and the theory of spectral Multiplicity, second Edition, Chelsea Publishing Co. N.Y. 1977.
2. N. Dunford and J.T. Schwartz, Linear operator-3 part inter science/Wiley New York, 1978-71.
3. G. Bachman and L. Narzil, Functional analysis from academic press



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Mechanics-I**
Optional Gr. : **Optional -VI**

Max. Marks : 80

Unit-I Free and constrained system. Constraints and their classification. Possible and virtual displacements. Ideal constraints. General equation of dynamics Lagrange's equation of the first kind. The principles of virtual displacements. D'Alembert's principle. [As in chapter-1.

{1, 2, 3, 4 of recommended books].

Unit-II Holonomic systems Independent coordinates. Generalized forces Lagrange's equation at the second kind in independent coordinates investigating Lagrange's equations. Theorem on variation of total energy potential, Gyroscopic and dissipative forces. [As in chapter-1.

{7,6,7,8 of recommended books].

Unit-III Lagrange's equations for potential forces, the generalized potential, Non-natural systems, Canonical equations of Hamilton Donkin's theorem, Generalized conservative system Routh's equation Cyclic coordinates. [As in chapter- 2. {11,12,13,14].

Unit-IV The Poisson bracket, Poisson's identity, Jacobi-Poisson theorem. Hamilton's Principle, second form of Hamilton's Principle. [As in chapter-2, {20 in chapter-3} 16,17].

Unit-V Attraction of rod, uniform circular plate, disc, spherical shells and sphere. Surface integral of normal attraction over any closed surface (Gauss's theorem) Laplace's and Poisson's equations. [As in chapter XIV [276 to 290 and in chapter XV 303 to 309]



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Text Books:-

1. F. Gautmacher, Lectures in Analytical Mechanics MIR Publishers Moscow 1977.
2. S.L. Loney, An elementary treatise on statics, Kalyani Publishers New Delhi 1979.

Reference Books:-

1. L.C. Evans, Partial Differential Equations, graduate studies in mathematics, volume 19, AMS 1998.
2. A.S. Ramsay, Newtonian Gravitation, The English Language book society and the Cambridge University Press.
3. N.C. Rana and P.S. Joog, Classical Mechanics Tata McGraw Hill, 1991.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class	:	M.Sc.
Semester	:	III
Subject	:	Mathematics
Paper Title	:	Fuzzy Sets and their applications-I
Paper	:	Optional -VII

Max. Marks : 80

Unit-I Fuzzy Sets- Definition and types of fuzzy sets, basic concepts, properties of α cuts and strong α cuts λ level sets, Convex sets, Algebra of convex fuzzy sets.

Unit-II Basic operation on fuzzy sets, representation of fuzzy sets, Decomposition theorems, Fuzzy complement and their Characterization Theorems. Cartesian product and Algebraic Product.

Unit-III Bounded sum and Bounded Difference, Fuzzy Intersection t-Norms and Fuzzy t-conforms, Combination of operation, Aggregation Operations.

Unit-IV Fuzzy numbers, arithmetic operations on intervals, arithmetic operations on fuzzy numbers, Lattice of fuzzy numbers, Fuzzy equations.

Unit-V Image of fuzzy sets, Inverse Image of a Fuzzy sets, Interval Valued Fuzzy Sets, Extension Principle for fuzzy sets and its properties.

RECOMMENDED BOOKS :-

- 1 Fuzzy Sets and Fuzzy Logic - G.J. Klir and B. Yuan Prentice Hall of India, New Delhi, 1997
- 2 Fuzzy sets and their applications- Pundir and Pundir, Pragati Prakashan.

REFERENCE BOOKS:-

1. Fuzzy Sets Theory and its Application-H.J. Zimmermann, Allied Publishers Ltd; New Delhi, 1991.
2. Fuzzy sets and Uncertainty and Information- G.J. Kalia Tina A. Foljer Prentice Hall of India.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Operations Research-I**
Optional Group : **Optional -VIII**

MM- Theory 80

- Unit-1** Operations Research and its scope, Origin and Development of Operations Research, Characteristics of Operations Research,
- Unit-2** Model in Operations Research, Phase of Operations Research, Uses and Limitations of Operation Research, Linear Programming Problems.
- Unit-3** Mathematical Formulation, Graphical Solution Method.
- Unit-4** General Linear Programming Problem : Simplex Method exceptional cases, artificial variable techniques ; Big M method, two phase Method and Cyclic Problems, problem of degeneracy.
- Unit-7** Duality, Fundamental Properties of duality and theorem of duality.

RECOMMENDED BOOKS :-

- 1- Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

REFERENCE BOOKS:-

- 1- S.D, Sharma, Operation Research,
- 2- F.S, Hiller and G.J. Lieberman, Industrial Engineering Series, 1997 (This book comes with a CD containing software)
- 3- G. Hadley , Linear Programming, Narosa Publishing House. 1997.
- 4- G. Hadley, Linear and Dynamic programming, Addison-Wesley Reading Mass.
- 7- H.A. Taha, Operations Research - An introduction, Macmillan Publishing co. Inc. New York.
- 6- Prem Kumar Gupta and D.S. Hira, Operation Reasearch, an Introduction, S. Chand & Company Ltd. New Delhi.
- 7- N.S. Kambo, Mathematical Programming Techniques, Affiliated East - West Pvt. Lt



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Wavelets-I**
Paper : **Optional -IX**

Max. Marks : 80

- Unit-1** Haar's simple wavelets
- Unit-2** Haar Wavelet transforms, Inverse Haar Wavelet transforms,
- Unit-3** Multi dimensional wavelets, Two - dimensional Haar Wavelets.
- Unit-4** Application of wavelets, Noise reduction Data compression, Edge detection, Daubechies wavelet (DW).
- Unit-7** Approximation of samples with D wavelets, Fast DW transform and its inverse.

TEXT BOOKS:-

- 1- Wavelets made easy by Y. Nieveregelt
- 2- A first Course on Wavelets by E. Hernandez and G. Weiss.

REFERENCE BOOKS.

- 1- An Introduction to Wavelets by Chui, Academic Press.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper Title : **Integral Transform-I**
Paper : **Optional -X**

Max. Marks : 80

- Unit-I** Laplace Transform, Inverse Laplace Transform. Transforms of derivatives, shifting theorem, convolution Theorem.
- Unit-II** Application to Differential Equations, Application to Integral equations. Solution of simulates differential equations.
- Unit-III** Laplace Equation in two dimension, Wave Equation in one dimension Application to wave equation.
- Unit-IV** Application of Laplace Transform to electrical circuits, Application to Beams.
- Unit-V** Heat conduction equation in one dimension, Application to heat conduction equation.

Books Recommended :-

1. Integral Transforms by Goyal and Gupta
2. Integral Transform by Sneddon.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper title : **Advance Programming in 'C'**
Paper : **Optional - XI**

M.M. Theory - 60

Unit-I User Defined Functions : Introduction, need for user defined functions, a multifunction program, the form of C functions, return values and their types, calling a function, category of functions, no arguments and no-return value, arguments with return values, handling of non-integer functions, nesting of functions, recursion, functions with arrays, the scope and lifetime of variables in functions, built-in C functions.

Unit-II Handling of character strings : Introduction, declaring and initializing string variables, Reading strings form terminal, writing strings to screen, arithmetic operations on characters, putting strings together, comparison of two strings, string handling functions.

Unit-III Structures & Union : Introduction, structure definition, giving values to members, structure initialization, comparison of structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions, union, size of structures, bit fields.

Unit-IV Pointers : Introduction, understanding pointers, accessing the address of a variable, declaring and initializing pointer, accessing a variable through its pointers, pointer expressions.

Unit-V File Management in C- Introduction, defining and opening a file, closing a file, input/output operations on files, error handling during I/O operations, random access to files, command line arguments.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Recommended Book :-

1. Samuel P. Harkison and Gly L. Steele Jr. C; A Reference manual, 2nd Edition
Prentice Hall 1984.
2. Brain W. Kernigham & Dennis M. Ritchie the C Programmed Language 2nd
Edition (ANSI features), Prentice hall 1989.
3. E. Balaguruswami (ANSI C)

Practical List :-

Max. Marks : 27

1. WAP to find simple interest using function.
2. WAP to illustrate nesting of function.
3. WAP to illustrate multiple function in a program.
4. WAP to add two strings.
5. WAP to compare two strings.
6. WAP to illustrate arrays of structure.
7. WAP to illustrate structure within structure.
8. WAP to illustrate pointer variable.
9. WAP to defining and opening a file.
10. WAP to input/output operations on files.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **III**
Subject : **Mathematics**
Paper title : **Integration Theory-I**
Paper : **Optional - XII**

Max. Marks : 80

Unit-I General Measure Space : Measures and measurable sets, continuity of measure, Borel Cantelli's Lemma, finite and σ -finite measures, completion of measures space.

Unit-II Signed measure, Hahn Lemma, Hahn Decomposition Theorem, Jordan Decomposition Theorem. Caratheodory measure induced by an outer measure.

Unit-III Construction of Outer measures, extension of a premeasured to a measure. Caratheodory-Hahn Theorem.

Unit-IV Integration over general Measure Spaces : Measurable functions, Simple Approximation Theorem, Egoroff's Theorem.

Unit-V Integration of nonnegative measurable functions, chebychev's inequality, fatou's lemma, Monotone Convergence theorem, Beppo Levi's lemma.

Text Books :-

Real Analysis by H.L. Royden and P.M. Fitzpatrick, PHI learning Pvt. Ltd., 4th Edition, 2010



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : M.Sc.
Semester : III
Subject : Mathematics
Paper title : Spherical Trigonometry and Astronomy-I
Paper : Optional - XIII

Max. Marks : 80

Unit-I Great circle and small circle, shortest distance joining two points on the surface of a sphere. Properties of poles spherical radius & angle.

Unit-II Polar triangles – Relation between the sides and angles properties of spherical triangles. Cosine and sine formulae.

Unit-III Formula for half angle and half a side supplemental sine- cosine formulae cotangent formula.

Unit-IV Napier's Analogies, De almer's Analogies, Right angled triangles.

Unit-V Position on earth, Lalitude and longitude, system of stars, Rate of change of zenith distance and Azimuth.

Text Books :-

1. A text book of spherical trigonometry : Gorakh Prasad
2. A text book of spherical Astronomy : Gorakh Prasad

Reference Books :-

1. Spherical Astronomy : Smarat
2. Spherical Astronomy : Bell



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

FOURTH SEMESTER/SESSION: 2016-2017

1. Course Code : _____
2. Course Name : **M.Sc. (Mathematics)**
3. Total Paper : **05**
4. Compulsory Paper : **01**
5. Optional Paper : **04**
6. Practical : **Y**

Paper code	Subject Name	Theory										Practical		Total	
		Paper					CCE		Total Marks			Max.	Min.	Max.	Min.
		1 st	2 nd	3 rd	Max.	Min.	Max.	Min.	Max.	Min.					
Compulsory															
	Internship /Project	100	0	0	100	35	0	0	100	35	0	0	100	35	
	Functional Analysis-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
Optional Paper Select any four															
	I Partial differential Equations-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	II Algebraic topology-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	III Advanced Graph Theory-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	IV Advanced special function-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	V Theory of linear operators-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	VI Mechanics-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	VII Fuzzy sets and their application-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	VIII Operations research -II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	IX Wavelets -II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	X Integral Transform -II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	XI Programming in C++-II (Theory and Practical)	60	0	0	60	21	20	7	80	28	20	07	100	35	
	XII Integration Theory-II	80	0	0	80	28	20	7	100	35	0	0	100	35	
	XIII Spherical Trigonometry and Astronomy-II	80	0	0	80	28	20	7	100	35	0	0	100	35	



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Functional Analysis-II**
Paper : **Compulsory**

Max. Marks : 80

Unit- I Hilbert adjoint operator and its properties, self adjoint, Unitary and normal operators positive operator.

Unit-II Zorn's Lemma Hahn-Banach Theorem for real linear spaces, Hahn-Banach theorem for complex linear space and normed linear spaces.

Unit-III Adjoint operators on normed spaces, relation between adjoint operator and Hilbert adjoint operator, Reflexive spaces, Reflexivity of Hilbert space.

Unit-IV Category theorem- Baire's Category theorem, uniform boundedness theorem and some of its application, strong and weak convergence in normed spaces.

Unit-V Convergence of sequences of operators and functionals, open mapping theorem, closed graph theorem, contraction theorem.

Text Books :

1. E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, New York 1978.
2. G.F. Simmons, Introduction to Topology & Modern Analysis McGraw Hill, New York.

Reference :

1. B. Choudhary and Sudarshan Nanda, Functional Analysis with applications, Wiley Eastern Ltd.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Partial Differential Equations-II**
Optional Gr. : **Optional -I**

Max. Marks : 80

Unit-I Uniqueness of the solution for the wave equation duhamel's principle, Green's function : introduction, green's function for laplace, the method of images, the eigen function, Green's function for the Wave equation- Helmholtz theorem.

Unit-II Green's function for the diffusion equation, Transform of some elementary function, properties of Laplace transform, final value theorem, transform of a periodic function, transform of a error function.

Unit-III Transform of a Bessel's function, transform of dirac delta function, Inverse transform, Convolution Theorem, transform of unit step function, complex inversion formula (Mellin fourier integral), Solution of ordinary differential equation.

Unit-IV Solution of partial differential equation: solution of diffusion equation, solution of a wave equation, Fourier transform methods: fourier integral representations: fourier integral theorem, sine and cosine integral representations, fourier transform pairs.

Unit-V Transform of elementary functionals, properties of fourier transform, parseval's relation, transform of dirac delta function, multiple fourier transform, finite fourier transform : finite sine transform, finite cosine transforms.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Text Books :-

K. Sankara Rao introduction to partial differential equations (2003).

Reference Book :-

Evans, partial differential equations (1998).



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Algebraic Topology-II**
Paper : **Optional -II**

Max. Marks : 80

- Unit-I** Free product of groups. (Art 68).
Free groups (Art 69).
The Seifert. Van. Kampen Theorem (theo. 70.1)
- Unit-II** Fundamental group of surfaces,
Polygonal region, labelling n fold torus (Art 74). Homology of
surfaces, first homology group (Art 77)
- Unit-III** Cutting and pasting, Classification theorems, (Art 76 and 77).
- Unit-IV** Classification of covering spaces, equivalence of covering spaces
universal covering spaces, Covering transformations. (Art 79, 80,81).
- Unit-V** covering spaces of a graph, linear graph, Fundamental group of
graph. Sub groups of free groups. (Art 83,84,80).

Books Recommended:-

1. J.R. Munkers, Topology, Second edition, Prentice Hall of India, 2000.

Reference Book :-

1. J.R. Munkers, Elements of Algebraic Topology, Addison- Wesley Publishing Company, 1984.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : M.Sc.
Semester : IV
Subject : **Mathematics**
Paper Title : **Advanced Graph Theory- II Paper**
: **Optional -III**

Max. Marks : 80

Unit- I Matrix representation of graphs, Incidence matrix, Submatrices of $A(G)$, Circuit Matrix, Fundamental circuit matrix and Rank of B , An application to a switching Network.

Unit-II Cut-set Matrix, Relationships among A_f , B_f and C_f , path matrix, Adjacency matrix.

Unit-III Chromatic Number, chromatic Partitioning, chromatic Polynomial, Coverings, matching's.

Unit-IV The four color problem, directed graph, some types of Digraphs, Digraphs and Binary relations, Euler digraphs, Directed paths and connectedness.

Unit-V Trees with directed graphs, Arboreocence, Fundamental Circuits in Digraphs. Matrix A , B and C of Digraphs, Adjacency matrix of a Digraph.

Text Book :-

Graph theory with applications to Engineering and computer science by Narsingh Deo.

Reference Book :-

Graph theory by Harary



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Advanced Special Function-II Paper**
: **Optional -IV**

Max. Marks : 80

Unit-I Bessel function, Bessel's differential equation, Generating function, Bessel's integral with index half and an odd integer.

Unit-II Generating function for legendre polynomials, Rodrigues formula, Bateman's generating function, Additional generating functions.

Unit-III 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.

Unit-IV Laguerre Polynomials : The Laguerre Polynomials $L_n(X)$, Generating functions, Pure recurrence relations, Differential recurrence relation, Rodrigue's formula.

Unit-V Jacobi polynomial. Generating functions, Differential Equation of Jacobi Polinomial, Orthogonal Properties.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Books Recommended :-

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.

Reference Books :

1. Lebedev, N.B., Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New Jersey, USA 1997.
2. Whittaker, E.T. and Watson, G.N., A course of Modern Analysis Cambridge University Press, London, 1963.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Theory of Linear Operators-II Paper**
: **Optional -V**

Max. Marks : 80

Unit-I Further spectral properties of compact linear operators, Operator Equation involving compact linear operators,

Unit-II Further theorems of Fredholm type, Bi-orthonormal system, Fredholm Alternative, Equicontinuous sequence, compact integral operator.

Unit-III Spectral properties of Bounded Self-Adjoint linear operators, Further Properties of Bounded Self-Adjoint linear operators.

Unit-IV Positive operators : Product of positive operators, monotone sequences of bounded self adjoint operators, square roots of positive operator.

Unit-V Projection Operators : Product and sum of projections.
Further properties of projections.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Text Books :-

1. E. Kreyszig, Introductory Functional Analysis with Application, John Wiley & Sons, New York 1978.
2. G.F. Simmons, Introduction to Topology & Modern Analysis McGraw Hill. New York.

References :-

1. P.R. Halmos, Introduction to Hilbert space and the theory of Spectral Multiplicity, Second Edition, Chelsea Publishing co. Y.Y. 1977.
2. N. Dunford and J.T. Schwartz, Linear operator-3 part inter science/Wiley New York.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Mechanics-II**
Optional Gr. : **Optional -VI**

Max. Marks : 80

Unit-I The basic integral invariant of mechanics (poincare- cartan integral invariant), Generalized conservative system, Whittaker's equation, Jacobi's equation. The Maupertuis- Lagrange principle of least action. Inertial motion Relation to Geodesic lines in the Arbitrary motion of a conservative system. [As in chapter-3. {Art. 18, 20, 21}].

Unit-II The universal integral Invariant of paincare lee Hawa- Chungi's Theorem, Canonical transformations. Free canonical transformations. [As in chapter-3, {Art. 22,24, 27}].

Unit-III The Hamilton-Jacobi equation, Jacobi's theorem method of separation of variables. Applying canonical transformation to perturbation theory. [As in chapter-4, {Art. 26,27,28}].

Unit-IV Testing the canonical character of a transformation. The Lagrange Brackets. The simplicial nature of the Jacobian Matrix of a canonical transformation invariance of the Poisson Brackets in a canonical Transformation. [As given in {Art. 30,28,32}].

Unit-V The potential of a mass at any point, potential of a thin uniform rod, circular plate, uniform spherical shell, uniform solid sphere, work done by self attraction systems. Distribution for a given potential, Equipotential surface. Surface and solid harmonics surface density in term of surface harmonics. [As given in chapter XIV & XV]



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Recommended Text :-

1. F. Gautmachar, Lectures in Avalytz Machineons MTR Publishers Moscow 1977.
2. S.L. Loney, An elementary treatise on statics, Kalyani Publishers New Delhi 1979.

Recommended Text :-

1. L.C. Evans, Parra's D. thereinlia equation, graduate studies in mathematics, value 19, AMS 1998.
2. A.S. Ramsay, Newtonician Gravitation, The English Language book society and the Cambridge University Press.
3. N.C. Ranu & P.S. Joog, Classical Mechanics Tata McGraw Hill, 1991.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper title : **Fuzzy Sets and their Applications-II Paper**
: **Optional -VII**

Max. Marks : 80

Unit-I Fuzzy relation on fuzzy sets, Projection and Cylindrical Extensions, Composition of Fuzzy Relation, Min Max Composition and its properties.

Unit-II Binary fuzzy relation, binary relation on a single set, Fuzzy equivalence relation, Fuzzy compatibility relation, Fuzzy relational equation, similarly relation. Fuzzy ordering relation, Fuzzy morphisms.

Unit-III Possibility Theory- Fuzzy measures, Evidence theory, Probability assignment (BPA), Dempster's rule of combined Evidence, Probability measure, Possibility and necessity measure.

Unit-IV Possibility distribution, Possibility theory, Fuzzy sets and Possibility Theory, Versus Probability Theory.

Unit-V Fuzzy logic, Multivalued logic, Fuzzy propositions, Fuzzy quantifiers, Linguistic hedges, Inference from conditional Fuzzy propositions, Inference from conditional and qualified Fuzzy propositions.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

RECOMMENDED BOOKS :-

- 1 Fuzzy sets and Fuzzy logic - G.J. Klir and B. Yuan Prentice Hall of India, New Delhi,1997.
- 2 Fuzzy sets and their applications- Pundir and Pundir, Pragati Prakashan.

REFERENCE BOOKS:-

1. Fuzzy Sets Theory and its Application- H.J. Zimmermann, Allied Publishers Ltd; New Delhi, 1991.
2. Fuzzy sets and Uncertainty and Information- G.J. Kalia Tina A. Foljer Prentice Hall of India.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Operations Research-II**
Paper : **Optional - VIII**

Max. Marks : 80

Unit-I Transportation problems : North- West Corner Method Least-Cost Method. Vogel's Approximation Method, MODI Method. Exceptional cases and problem of degeneracy.

Unit-II Assignment problems, Non-Linear Programming Techniques-Kuhn-Tucker Conditions, Non-negative constraints.

Unit-III Network analysis, constraints in Network, Construction of network, Critical Path Method (CPM) PERT, PERT calculation, Resource Leveling by Network Techniques and advances of network (PERT/CPM).

Unit-IV Simulation : Monte-Carlo Simulation. Simulation of Networks, Advantage and Limitation of Simulation.

Unit-V Game theory- Two persons, Zero-sum Games, Maximix- Minimax principle, games without saddle points- Mixed strategies, Graphical solution of $2 \times m$ and $m \times 2$ games, solution by Linear Programming.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Recommended Books :-

1. Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

Reference Books :-

1. S.D. Sharma, Operation Research.
2. F.S. Hiller and G.J. Lieberman, Industrial Engineering Series, 1997 (This book comes with a CD containing Software).
3. G. Hadley, Linear programming, Narosa Publishing House 1997.
4. G. Hadley, Linear and dynamic programming, Addison- Wesley Reading mass.
5. H.A. Taha, Operations Research – An Introduction Macmillan Publishing.
6. Prem Kumar Gupta and D.S. Hira, Operations Research, an Introduction S. Chand & Company Ltd. New Delhi.
7. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Pvt. New Delhi, Madras.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Wavelets -II**
Paper : **Optional -IX**

Max. Marks : 80

Unit - I Inner Products and orthogonal Projection. Applications of orthogonal projection to computer graphics.

Unit-II Computation of functions and wavelets, Discrete and fast Fourier transform with inverse and applications.

Unit-III Fourier series for periodic functions. Its convergence and inversions.

Unit-IV Uniform convergence of Fourier series, Bessel's inequality, Parseval's inequality.

Unit-V The Fourier transform, Convolution and inversion of Fourier transform, Weight functions approximate identities.

TEXT BOOKS:-

1. Wavelets made easy by Y. Nievergelt.
2. A first course on Wavelets by E. Hernandez and G. Weiss.

REFERENCE BOOKS:-

1. An introduction to Wavelets by Chuui, Academic Pres .



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Integral Transform-II**
Paper : **Optional -X**

Max. Marks : 80

Unit-I Fourier Transform, Infinite Fourier transform, Complex Fourier transform.

Unit-II Finite Fourier Transform and Fourier Integral.

Unit-III Convolution theorem, Parseval's Identity for Fourier series, Parseval's Identity for Fourier transform.

Unit-IV Application for Fourier Transform to Boundary value problems.

Unit-V Introduction to Hankel and Mellin Transforms, Fourier Series and Boundary value problems.

Books Recommended :-

1. Integral Transforms by Goyal and Gupta.
2. Integral Transform by I.N. Sneddon.
3. Integral transform by Gupta and Vashishtha.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Programming in C++**
Paper : **Optional -XI**

Max. Marks : 60

Unit-I Principles of OOPs, procedure oriented programming vs. object oriented programming, basic concepts, advantages, application of OOPs Object oriented languages, structure of C++ program, creating, compiling, linking & executing a C++ program. Tokens, expressions & control structures, keywords, identifiers, basic data types, user-defined data types, derived data types.

Unit-II Operators in C++ : Scope resolution operator, memory management operators, manipulators, type cast operators, operators, operator precedence, control structures, functions in C++, Main function, function prototyping, call by reference vs. call by value, inline functions, default arguments, const arguments, function overloading, friend functions.

Unit-III Classes and objects : specifying a class, defining member functions, making an outside functions inline, private member function; array within a class, memory allocation for object; static data members, static member functions, array of objects, objects as function arguments, returning objects.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Unit-IV Constructors and Destructors: Constructors, parametric constructors, multiple constructor in a class, constructors with default arguments. dynamic initialization of objects, copy constructors, dynamic constructors, destructors.

Unit-V Operator overloading & type conversions : Definition of overloading & operator overloading, rules for overloading operators, overloading unary operators, Binary operators using friends. Inheritance: defining derived classes, single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance.

Reference Books:-

1. E. Balaguruswami Object oriented Programming with C++ Forth edition
(McGraw Hill)

Practicals:-

Max. Marks-27

1. Program to find roots of quadratic equation.
2. Program to find compound interest using class.
3. Program to illustrate array operation.
4. Program to check whether a number is prime or not prime.
5. Program to illustrate constructor and destructor.
6. Program to illustrate operator overloading.
7. Program to generate Fibonacci series.
8. Program for reversing an array using class.
9. Program to calculate factorial of a given number using class.
10. Program to illustrate inheritance.
11. Program to illustrate friend function.
12. Program to illustrate multiple inheritance.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper Title : **Integration Theory-II**
Paper : **Optional -XII**

Max. Marks : 80

Unit-I Integration of General Measurable Functions : Integral Comparison Test, Countable additivity over domain of integration, continuity of integration, Lebesgue dominated convergence theorem.

Unit-II Uniformly integrable and tight sequence of functions, Vitali convergence theorem absolute continuity of measure, The Radon-Nikodym Theorem, Lebesgue Decomposition Theorem.

Unit-III Product Measure, Theorems of Fubini and Tonelli.

Unit-IV Lebesgue measure on \mathbb{R}^n and its regularity. Cumulative Distribution Functions and Borel Measure on \mathbb{R} .

Unit-V Construction of Radon Measure, positive linear functional on $C_c(X)$, Riesz Markov Theorem.

TEXT BOOKS:

H.L. Royden and P.M. Fitzpatrick, Real Analysis, PHI learning Pvt. Ltd. 4 Edition, 2010.



SARVEPALLI RADHAKRISHNAN UNIVERSITY, Bhopal (M.P.)

Class : **M.Sc.**
Semester : **IV**
Subject : **Mathematics**
Paper title : **Spherical Trigonometry and Astronomy-II Paper**
: **Optional -XIII**

Max. Marks : 80

Unit-I Fundamental definitions, motion of sun, Twilight.

Unit-II Dip of the horizon, Refraction, meridian circle.

Unit-III Kepler's Laws of planetary motion, time.

Unit-IV Planetary motion and phenomena, Aberration.

Unit-V Precession and nutation, parallax and eclipses.

Text Books :-

1. A text book of spherical trigonometry : Gorakh Prasad.
2. A text book of spherical Astronomy : Gorakh Prasad.

Reference Books :-

1. Spherical Astronomy : Smarat
2. Spherical Astronomy : Bell