KAKATIYA UNIVERSITY
M.A / M.Sc. MATHEMATICS syllabus (w.e.f. 2019-20)
Semester - III
Paper – I
Paper Code: M3CP1
MEASURE AND INTEGRATION

UNIT I

Algebra of sets – Borel sets
Measurable Sets: Outer Measure - Properties of Outer Measure - Measurable Sets and Lebesgue Measure - Properties of Measurable Sets - Sequences of Measurable sets - A Nonmeasurable Set.
(Sec 1.4, 2.7, Chapter 3: Sec1 to 4 of the Text Book)

UNIT II

Measurable Functions: Properties of Measurable Functions - Sequences of Measurable Functions - Almost everywhere concept - Measurability of a Characteristic Function - Simple and Step Functions - Egoroff's Theorem.
Lebesgue Integral: The Riemann Integral - The Lebesgue Integral of a Bounded Measurable Function over a Set of Finite Measure - The necessary and sufficient condition for measurability of bounded function - Properties of integral of bounded measurable functions - Bounded convergence Theorem.
(Chapter 3: Sec 5 to 6 and Chapter 4: Sec 1to 2 of the Text Book)

UNIT III

The Lebesgue in Integral of a Nonnegative Function: Properties of Integral of Nonnegative functions - Fatou's Lemma - Monotone Convergence Theorem - Some propositions related to Integrals - The General Lebesgue Integral - Properties of Lebesgue Integrals - Lebesgue Dominated Convergence Theorem.
(Chapter 4: Sec 3 to 4 of the Text Book)

UNIT IV

Differentiation and Integration: Statement of Vitali Covering lemma - The four Dini's derivatives of a function – Functions of bounded variation - A theorem on integral of a differentiable function - Differentiation of an Integral - Absolute Continuity.
(Chapter 5: Sec 1to 4 of the Text Book)

Text Book:

Real Analysis by H.L.Royden, PHI, 3rd Edition

Reference Books:

1. Measure Theory by P.R.Halmos, Vaan Nostrand, Princeton.
2. An Introduction to Measure and Integration by Inder K. Rana, Narosa Publications.

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M.A. / M.Sc. MATHEMATICS Syllabus (w.e.f. 2019-20)
Semester –III
Paper –II
Paper Code: M3CP2
FUNCTIONAL ANALYSIS

U N I T I

Banach Spaces: The definition and some Examples - Continuous Linear Transformations - The Hahn-Banach Theorem - The Natural imbedding of N in N**

U N I T I I

The Open Mapping Theorem - The Conjugate of an Operator.
Hilbert Spaces: The Definition and some Examples - Orthogonal Complements.

U N I T III

Orthonormal Sets - The Conjugate Space H* - The Adjoint of an Operator - The Self-Adjoint Operators.

U N I T IV

Normal and Unitary Operators – Projections - The Spectral Theorem.

Text Book :

Introduction to Topology and Modern Analysis by G.F. Simmons.

Reference Books:

1. Functional Analysis by G. Backmenn and Narici
2. Functional Analysis by P.K. Jain IP, Ahuja and Khalil Ahmed.
3. Introductory Functional Analysis with Applications by E. Kreyszig.
4. Functional Analysis by B.V. Limaye.
5. A First Course in Functional Analysis by G. Goffman and G. Pedick Prentice Hall of India.

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper –III
Paper Code: M3CP3

PARTIAL DIFFERENTIAL EQUATIONS

U N I T - I: FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS

Formation of First Order Partial Differential Equations – Solution of Linear First Order Partial Differential Equations (Langrange's Method)- Integral Surfaces Passing Through a Given Curve - Surfaces Orthogonal to a Given System of Surfaces-Compatibility of First Order Partial Differential Equations – Classification of the Solutions of First Order Partial Differential Equations - Solutions of Non-Linear Partial Differential Equations of First Order – Charpit's Method - Jacobi's Method - Special Types of First Order Equations .
[Sections 1.1 to 1.9.3 of text book.]

U N I T - I I: SECOND ORDER PARTIAL DIFFERENTIAL EQUATIONS.

Second order Partial Differential Equations – Origin – Linear Partial Differential Equations with Constant Coefficients - Methods of Solving Linear Partial Differential Equations – Classification of Second Order Partial Differential Equations - Classification of Second Order Partial Differential Equations.
[Sections 2.1 to 2.4.1 of text book.]

U N I T - III : ELLIPTIC DIFFERENTIAL EQUATIONS

Boundary Value Problems – Separation of Variable method - Laplaces equation in Cylindrical and Spherical coordinates - Interior and exterior Dirichlet problem for a circle – Interior Dirichlet problem for a Sphere- Interior Neumann problem for a Circle - Miscellaneous examples.
[Sections.3.2 to 3.10 (3.10.1,3.10.2,3.10.3]

U N I T – IV: PARABOLIC DIFFERENTIAL EQUATIONS

Solution of Diffusion by Separation of Variables Method - Diffusion Equation in Cylindrical and Spherical coordinates – D'Alembert solution of one dimensional Wave Equation – Separation of Variable Method - Two Dimensional Wave Equation – Separation of Variable Method- Two Dimensional Wave Equation
[Sections 4.1, 4.2, 4.3, 4.4, 5.3, 5.4, 5.5, 5.10.]

Text Book:

Partial Differential Equations for Engineers and Scientists by J.N. Sarma and Kehar Singh Published by Narosa Publishing House.

Reference Books:

1. Elements of partial Differential Equations by I.N. Sneddon
2. Partial Equations by L.C Evans.
3. Partial Differential Equations by Prasad & Ravindran.

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper –IV (Elective)
Paper Code: M3OP4 (1)

Mathematical Modelling

UNIT I

Hyper planes – Hyper spheres – Convex sets and their properties –Mathematical formulation of a LPP - Graphical solution method- General LPP - Canonical and Standard form of a LPP. Basic solution – Degenerate solution – Basic feasible solution – Improved basic feasible solution - Optimum basic feasible solution – Fundamental properties of solutions-Reduction of a feasible solution to a basic feasible solution – Fundamental theorem of linear programming - Improved basic feasible solution - Existence of unbounded solution – Conditions of optimality – The Simplex algorithm.

UNIT II

Use of Artificial Variables – Two-Phase Method - Big M-Method – Degeneracy in linear programming - Duality – General Primal-Dual pair – Formulating a Dual problem – Primal-Dual pair in matrix form - Duality theorems – Duality and Simplex method - Dual simplex method.

UNIT III

Transportation problem- Matrix form of T.P. – special case of LPP Transportation table-Initial Basic Feasible Solution – North West Corner Rule, Matrix - Minima Method, Vogel approximation method of finding initial basic feasible solution – loops in a T.P. – Transportation Algorithm of finding optimal solution - Degeneracy in T.P. – Unbalanced T.P.

UNIT IV

Assignment problems – Hungarian method of finding optimal assignment problems – Travelling Salesman Problem.
Integer programming – all & mixed integer programming problems- Gomory's All IPP method- Gemory's mixed integer programming – branch and bound method .

Text-Book:

Operations Research by Kanti Swarup. P.K.Gupta and Manmohan.

Reference Books:

1. Operations Research by Handy A.Taha. Printice Hall of India.
2. Linear programming methods and applications by Gass. S.I

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M.A / M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester - III
Paper – IV (Elective)
Paper Code: M3OP4 (2)
NUMERICAL ANALYSIS

U N I T I

Initial Value Problems for Ordinary Differential Equations**:** The Elementary Theory of Initial Value Problems – Euler's Method – Higher-Order Taylor Methods – Runge-Kutta Methods – Multistep Methods.

U N I T I I

Direct Methods for solving Linear Systems: Linear system of equations-Matrix Factorizatoin-Special Types of Matrices-Iterative Techniques in Matrix Algebra –The Jacobi and Gauss-Seidel Iterative Techniques.

U N I T III

Numerical Solutions of Nonlinear Systems of Equations : Fixed Points for Functions of Several Variables – Newton's Method – Quasi-Newton Methods – Steepest Descent Techniques.

U N I T IV

Boundary-Value Problems for Ordinary Differential Equations **:** The Linear Shooting Method – The Shooting Method for Nonlinear Problems – Finite-Difference Methods for Linear Problems – Finite-Difference Methods for Nonlinear Problems

Text Book :

Numerical Analysis by Richard L.Burden and J.Douglas Faires, 9th Edition, Brooks/Cole, Cengage Learning

Reference books:

1. Introductory Methods of Numerical Analysis, by S.S. Sastry, PHI.
2. Numerical Methods for Scientific and Engineering Computation byM. K.Jain, S.R.K. Iyengar and R.K.Jain.

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M.A. / M.SC. MATHEMATICS Syllabus (w.e.f. 2019-20)
Semester –III
Paper –IV (Elective)
Paper Code: M3OP4 (3)
AUTOMATA AND LANGUAGES

UNIT I

Mathematical Preliminaries: Sets, relations and functions – Graph – Trees - Strings and their properties - Principle of induction.
The theory of Automata: Definition of automation - Description of a finite automation - Transition systems.
(Chapter 1: Sec 1.1 to1.4 and Chapter 2: Sec 2.1 to 2.2 of Text Book)

UNIT II

Properties of Transition functions: Acceptability of a string by a finite automation - Non deterministic finite state machines - The equivalence of DFA and NDFA - Mealy and Moore models - Minimization of finite automata.
(Chapter 2: Sec 2.4 to 2.9 of Text Book)

UNIT III

Formal Languages: Basic definitions and examples - Chomsky classification of languages and their relations - Recursive and recursively enumerable sets - Operations on languages and automata.
(Chapter 3: Sec 3.1 to 3.6 of Text Book)

UNIT IV

Regular Sets and Regular Grammars: Regular expressions - Finite automata and Regular expressions - Pumping Lemma for regular sets - Applications of Puming Lemma - Closure properties of regular sets - Regular sets and regular grammar.
(Chapter 4: Sec 4.1 to 4.6 of Text Book)

Text Book:

Theory Computer Science (Automata, Languages and Computation) by K.L.P. Mishra and N. Chandrasekhar, PHI

Reference Books:

1.Introductory theory of computer science by E.V.Krishna Murthy, East-West Press.
2. Theory of Finite Automates with an introduction to formal languages by Carrel J and Lang D,PHI

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper –IV (Elective)
Paper Code: M3OP4 (4)
ADVANCED COMPLEX ANALYSIS

UNIT I:

Harmonic Functions: Harmonic functions – Borel-Carathodary theorem – Poisson's integral formula – Positive harmonic functions – Harnack's functions – Harnack's inequality – Harnack's principle
(Chapter 10: Sec 10.1 to 10.3 of Text Book)

UNIT II:

Conformal mappings and Bilinear transformations: Introduction – Conformality theorem – Bilinear transformations – Special bilinear transformations – Exponential and trigonometric transformations – Normal families – Montel's theorem and Riemann mapping theorem(Statement only)
(Chapter 11 of Text Book)

UNIT III:

Univalent functions: Definition of univalent functions and elementary properties – Area theorem – Coefficient conjectures – Coefficient estimates – Growth and distortion theorems – Function with positive real part
(Chapter 12 of Text Book up to theorem 12.8)

UNIT IV:

Subclasses of S, Entire and Meromorphic Functions: Starlike functions – Convex Functions – Close to convex functions – Infinite products – Meromorphic functions – Weirstrass theorem
(Chapter 12: Sec 12.2 , Chapter 13: Sec 13.1, 13.2 of Text Book)

Text Book:

Complex Variables by H.Silverman

Reference Books:

1. Complex Variables Theory and Applications by H.S.Kasana
2. Univalent Functions by P.C.Duren
3. Univalent Functions by A.W.Goodman(Vol I & II)

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K.A./M.Sc MATHEMATICS Syllabus (w.e.f.2019-20)
Semester-III
Paper-IV (Elective)
Paper Code: M3OP4(5)
COMMUTATIVE RINGS & MODULES

U N I T I

Modules – Homomorphisms - Exact Sequences- Free modules – Vector spaces
(Chapter 4: Sec 1 & 2 of Text Book)

U N I T I I

Projective Modules – Injective Modules – Hom & Duality
(Chapter 4: Sec 3 & 4 of Text Book)

U N I T III

Chain Conditions – Prime and Primary Ideals
(Chapter 8: Sec 1 & 2 of Text Book)

U N I T IV

Primary Decomposition - Noetherian Rings and Modules – Krull Intersection Theorem – Nakayamma lemma- Hilbert Basis Theorem.
(Chapter 8: Sec 3 & 4 of Text Book)

Text Book :

Algebra by Thomas Hungerford.

KAKATIYA UNIVERSITY
M.A./M.Sc MATHEMATICS Syllabus(w.e.f 2019-20)
Semester-III
Paper-IV (Elective)
Paper Code: M3OP4 (6)
MECHANICS OF SOLIDS

UNIT I

Introduction to Tensors: Coordinate transformations - Summation Convention – Contravariant - Covariant and mixed tensors - Symmetric and skew symmetric tensor - Fundamental operations with the tensors - The line element and metric tensor - Tensor form of gradient, divergence and curl.
(Scope as in Text Book 1)
Analysis of Strain: Deformation - Affine transformations - Infinitesimal affine transformations - Geometrical interpretation of the components of strain - Strain quadric of Cauchy - Principal strain and strain invariants - Examples of strain - Equations of compatibility (a simple derivation).
(Chapter 1 of the Text Book 2)

UNIT II

Analysis of Stress: Body and surface forces - Stress tensor - Equations of equilibrium - Transformation of coordinates - Stress quadric of Cauchy - Maximum normal and shear stress - Mohr's diagram - Examples of stress.
(Chapter 2 of the Text Book 2)

UNIT III

Equations of Elasticity: Generalized Hooke's law - Homogeneous isotropic media - Elastic moduli for isotropic media - Simple tension - Pure shear and hydrostatic pressure - Equilibrium equations for an isotropic elastic solid - Dynamical equations for an isotropic elastic solid - The strain energy function and it's connection with Hooke's law - Uniqueness of solutions.
(Chapter 3 of the Text Book 2)

UNIT IV

Basic Problems of Elasticity: Statement of problem - Extension of beams by longitudinal forces - Beam stretched by its own weight - Bending of beams by terminal couples - Torsion of circular shaft - Torsion of cylindrical beams - Stress function.
(Chapter 4: Sec 29-35 of the Text book 2)

Text Book:

1. Vector Analysis (For Unit-I, a) Introduction to Tensors) – Murray R Spiegel, Schaum's Series.
2. Mathematical Theory of Elasticity – I.S.Sokolnikoff, TMG- New Delhi.

Reference Books:

1. Theory of Elasticity – S.P.Timoshenco, J.N.Goodier.
2. Theory of Elasticity – PDS. Verma, Vikas Publications.

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code: M3OP5 (1)
COMPUTER FUNDAMENTALS AND PROGRAMMING IN C

UNIT I

Major Components of a Digital Computer - Computer Classification - User Interface - Hardware Software and Firmware - LAN and WAN.
Number System (Binary, Decimal, Octal and Hexadecimal) - Conversion of one Number System to another - Floating-Point Representation.
(Chapters 1, 2 of Text Book 1)

UNIT II

Constants – Variables – Data types – Operators – Expressions – Managing input and output operations
(Chapter 2, 3, 4 of Text Book 2)

UNIT III

Decision making and branching – Decision making and looping – Arrays - User defined function
(Chapters 5, 6, 7, 9 of Text Book 2)

UNIT IV

Structures and unions – Pointers - File management in C.
(Chapters 10, 11 and 12 of Text Book 2)

Text Book:

1. Computer Fundamentals, Architecture and Organization by B.Ram, 3rd Edition, New Age International (P) Limited.
2. Programming in ANSI C by E.Balagursamy, 4th Edition, Tata McGraw-Hill Education Pvt. Ltd.

Computer Lab Work

1. Program to print Biggest of 3 given numbers.
2. Program to print the roots of a quadratic equation
3. Program to print sum of N given numbers.
4. Program to print N prime numbers.
5. Program to check whether the given number is palindrome or not.
6. Implement functions to find whether a given number is prime or not.
7. Program to find the n^{th} Fibonacci number using recursion.
8. Program to multiply two matrices
9. Program to check whether the given string is palindrome or not.
10. Program to sort a given string.
11. Create a file of student records .
12. Program to swap two numbers using pointers.
13. Program to compute sum of elements stored in an array using pointers.
14. Program to read student records (name, roll, m1, m2, m3) as structure and sort according to name.
15. Program to read student records (name, roll, m1, m2, m3) as structure and print the result.

16. . Programs i)to create a file ii) to read the created file and display it contents..

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code: M3OP5 (2)
OFFICE AUTOMATION AND C – LANGUAGE

UNIT I

MS-Office, MS-Word – Basics – Header – Footer – Tables – Graphics – Templates – Macros.
MS-Excel – Worksheet – Formatting – Functions – Charts – Graphs – Worksheets and Data Strings.
(Text Book 1)

UNIT II

Overview of C – Constants - Variables and Data types - Operators and Expressions - Managing Input and Output operations.
(Chapters 1, 2, 3 and 4 of Text Book 2)

UNIT III

Decision making and Branching - Decision Making and Looping – Arrays - Handling Character Strings - User Defined Functions.
(Chapters 5, 6, 7, 8 and 9 of Text Book 2)

UNIT IV

Structures and Unions – Pointers - File Management in C.
(Chapters 10, 11 and 12 of Text Book 2)

Text Book:

1.Working in MS-Office – By Ron Mansfeild, Tata McGrawHill.

2. Programming in ANSI C by E.Balagurusamy, Third Edition, Tata McGraw-Hill

Reference Book:

MS-OFFICE For everyone by Sanjay Saxena, Vikas Publication.

Computer Lab Work

1. Prepare Curriculum Vitea of a student.
2. Mail Merge.
3. Create graphs(Line, Pie and Bar) in Excel
4. Simple macros in Excel.
5. Program to print Biggest of 3 given numbers.
6. Program to print sum of N given numbers.
7. Program to check whether the given number is palindrome or not.
8. Implement functions to find whether a given number is prime or not.
9. Program to find the n^{th} Fibonacci number using recursion.
10. Program to multiply two matrices
11. Program to check whether the given string is palindrome or not.
12. Program to sort a given string.
13. Create a file of student records .
14. Program to swap two numbers using pointers.
15. Program to read student records (name, roll, m1,m2,m3) as structure and sort according to name.
16. Program to copy contents of one file to another file.

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M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –III
Paper – V (Elective)
Paper Code: M3OP5 (3)
NUMERICAL ANALYSIS Using C

UNIT I

Transcendental and polynomial equations: Introduction - Bisection Method - Secant Method - Regula-Falsi Method - Newton-Raphson Method - Mullar Method - Chebyshev Method - Multipoint Iterative Methods - Rate of convergence
(Chapter 2: Sec 2.1, 2.2, 2.3, 2.4 and 2.5 of the Text Book)

UNIT II

System of linear algebraic equations and eigen value problems: Introduction
Direct Methods: Gauss-Elimination Method - Gauss-Jordan Method - Triangularisation Method - Cholesky Method - Partition Method - Error analysis for direct methods
Iteration Methods: Jacobi Iteration Method - Gauss-Seidel Iteration Method - Eigen Values and Eigen Vectors - Power Method - Inverse Power Method.
(Chapter 3: Sec 3.1, 3.2, 3.3, 3.4, 3.5, 3.11 and 3.12 of the Text Book)

UNIT III

Interpolation and approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Quadratic Interpolation - Higher Order Interpolation - Iterated Interpolation - Finite Differences Operators
Interpolating Polynomials using finite differences: Gregory-Newton forward difference interpolation - Backward difference interpolation - Stirling and Bessel interpolation - Hermite interpolation - Spline interpolation
Approximation: Least square approximation.
(Chapter 4: Sec 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 and 4.9 of the Text Book)

UNIT IV

Numerical differentiation and integration: Introduction
Numerical Differentiation: Linear interpolation - Quadratic interpolation - Methods based on finite differences - Methods Based on Undetermined Coefficients - Numerical Integration Methods Based on Interpolation: Newton-Cotes Methods - Open type integration Rules Composite Integration Methods: Romberg Integration - Double Integration.
(Chapter 5: Sec 5.1, 5.2, 5.6, 5.7, 5.9, 5.10 and 5.11 of the Text Book)

Text Book:

Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain, 5th Edition, New Age International (p) Limited Publishers

Reference Book:

An Introduction to Numerical Analysis by Kendall E. Atkinson

Numerical Analysis Laboratory

The following programs are to be executed in C/Fortran language.

1. Solution of system of n x n linear equations AX=B using Gauss Elimination method.
2. Finding solution of n x n linear equations AX=B using LU decomposition method.
3. Finding solution of n x n linear equations AX=B using Gauss-Seidel iteration method.
4. Finding the largest Eigen value in magnitude and the corresponding Eigen vector of an n x n matrix A by Power method.
5. Lagrange interpolation.
6. Newton-Gregory forward interpolation.
7. Newton-Gregory backward interpolation.
8. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Trapezoidal rule with 'n' subintervals.
9. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Simpson's $1/3^{rd}$ rule with '2n' subintervals.
10. Evaluation of the integral of f(x) between the limits 'a' and 'b' using Simpson's $3/8^{th}$ rule with '3n' subintervals.
11. Solution of equation by Bisection method.
12. Solution of equation by Regula - Falsi method.
13. Solution of equation by Newton-Raphson method.
14. Solution of equation by Mullar method.

Text/Reference Books:

1. Numerical methods for scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain.
2. Numerical methods by E. Balagurusamy.
3. Computer oriented Numerical methods by V. Raja Raman.