KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – I
Paper Code: M4CP1
ADVANCED LINEAR ALGEBRA

Review of Vector Spaces-Subspaces- Bases and Dimension-Coordinates.

UNIT I

Linear Transformations-The algebra of Linear Transformations – Isomorphism - Representation of Transformations by Matrices - Linear Functionals.
(Chapter 3: Sec 3.1 to 3.5 of the Text Book)

UNIT II

The double Dual - Characteristic Values - Annihilating Polynomials - Cayley Hamilton Theorem-Invariant Subspaces.
(Chapter 3: Sec 3.6, Chapter 6: Sec 6.1 to 6.4 of the Text Book)

UNIT III

Direct-sum Decompositions - Invariant Direct sums - The primary Decomposition theorem-Cyclic Subspaces and Annihilators – Statement of Cyclic Decompositions Theorem and its applications (except Generalized Cayley -Hamilton Theorem)- Rational Form.
(Chapter 6: Sec 6.6 to 6.8, Chapter 7: Sec 7.1 to 7.2 of the Text Book)

UNIT IV

Bilinear Forms: Bilinear forms - Symmetric Bilinear Forms - Skew Symmetric Bilinear Forms - Groups preserving Bilinear Forms
(Chapter 10: Sec 10.1 to 10.4 of the Text Book)

Text Book:

Linear Algebra by Kenneth Hoffman and Ray Kunze, 2nd Edition, Pearson (2003).

Reference Books:

1. Finite Dimensional Vector Spaces by p.Halmos,D Vanostrand,Princeton.
2. Linear Algebra by H.Friedberg etal, PHI(2007)
3. Linear Algebra by Lipschitz, Schaum Series.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – II
Paper Code: M4CP2
GRAPH THEORY

U N I T – I

Relations and Digraphs

Relations and Digraphs – Special Properties of Binary Relations – Equivalence Relations – Ordering Relations – Lattices and Enumerations – Paths and Closures – Directed Graphs and Adjacency Matrices

U N I T –I I

Graphs

Basic Concepts – Isomorphism and Subgraphs – Trees and their properties – Spanning Trees – Directed Trees – Binary Trees – Planar Graphs.

U N I T – III

Multigraphs

Euler's Formula – Konigsberg Seven Bridges problems – Multigraphs – Euler Circuits – Hamiltonian Graphs – Chromatic Numbers – The Four–Colour Problem.

U N I T – IV

Net works flows

Graphs as Models of Flow of Commodities – Flows – Maximal Flows and Minimal cuts- The Maxflow Min- Cut Theorem – Applications – Matching and Hall's Marriage Theorem.

TEXT BOOK :

Discrete Mathematics for Computer Scientists and Mathematicians By J.L. Mott. A. Kandle, P.Bakes.

REFERENCE BOOKS:

1. A First Book at Graph Theory – By John Clark and Derek Allan Hotton.
2. Discrete Mathematical Structures & Graph Theory – By Rao
3. A Text Book of Graph Theory and its applications – By B. Suryanarayana and G.K. Ranganath.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – III
Paper Code: M4CP3
INTEGRAL EQUATIONS AND TRANSFORMS

UNIT I

Integral Equation – Differentiation of a Function under an Integral Sign – Relation Between Differential and integral Equations – Solution of Non-homogeneous Volterra's Integral Equations by the method of Successive Substitution and Successive Approximation of some Resolvent Kernels – Volterra Integral Equation of First Kind.
(Sec 1.1 to 2.4 of Text Book 1)

UNIT I I

Solution of the Fredholm Integral Equation by the Method of Successive Substitution and successive approximation – Reciprocal Functions - Volterra's Solution of Fredholm's Equation – Statement of Fredholm first Theorem- Statement of Unique Solution of the Non-homogeneous Fredohlm Integral Equation – Integral equations with degenerate kernels - Symmetric Kernel – Eigen value of a Symmetric kernel- Real Characteristic Constants.
(Sec 2.5 to 2.9, 3.1, 3.2, 3.14 and 4.1, 4.4, 4.5. of Text Book 1)

UNIT III

Laplace Transforms – Existence of Laplace Transform – Properties of Laplace Transform- The inverse Laplace transform and properties – Convolution Theorem- Solution of ordinary differential Equations by Laplace Transforms- Solution of Ordinary Differential Equations with variable coefficients by Laplace Transforms.-
(Chapter 1, Chapter 2: Sec 2.1 to 2.15, Chapter 3: Sec 3.1, 3.2, of Text Book 2)

UNIT IV

Fourier Transforms – Fourier Integral Formula – Inversion Theorem for Complex Fourier Transform -Fourier Sine and Cosine Transform - Inversion of Formulae – Convolution Theorem-Parseval's identity -Finite Fourier Sine and Cosine Transforms - Inversion Formulae -Operational Properties – Convolution.
(Chapter 6:Sec 6.1 to 6.15, 6.17, 6.18, 6.19,Chapter7: Sec 7.1 to 7.4, 7.6, 7.7, 7.9, of Text Book 2)

Text Book:

1. Integral Equations by Shanty Swarup
2. Integral Transforms by A. R Vasistha and R.K. Gupta

Reference Book:

Advance Calculus for Applications by Francis B. Hilder Brand Prentic Hall of India

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV (Elective)
Paper Code: M4OP4(1)
NEAR RINGS

U N I T I

The Structure Of Near –Rings: Near-ring - The Near-Ring of all mappings on a group G - The Near-Ring of all zero respective mappings on G - Sub-Near-Ring - Abelian Near-Ring - Commutative Near-Ring - Zero Near-Ring - Zero Symmetric Near-Ring - Constant Near-Ring - Trivial Zero Symmetric Near-Ring and Trivial Constant Near-Ring - Near-ring homomorphism and isomorphism - Ideal (left, right) of a Near-Ring - Quotient Near-Ring - Natural homomorphism associated with an Ideal - Kernel of homomorphism - R-sub group (left, right) of a Near-Ring R - Simple Near-Ring.
(Chapter 1: Sec 1.1 to 1.40 of the Text Book)

U N I T II

Near-Ring Modules: R-module - Faithful representation - Centralizer Near-Ring - The right regular representation of a Near-Ring - R-sub module - Unital R-module - R-module homomorphism and isomorphism - Quotient R-module - Annihilator of a subset.
(Chapter 2: Sec 2.1 to 2.37 of the Text Book)

U N I T III

Primitive Near-Rings: Momogenic Near-Ring - R-module of type 0 - R-module of type 1 - R-module of type 2 - V-primitive Near-Ring - The Stabilizer.
(Chapter 3: Sec 3.1 to 3.37 of the Text Book)

U N I T IV

More on 2-Primitive Near-Rings: Rank – Projection - Minimal condition - Maximal condition – DCCS – DCCR – DCCI – ACCR – ACCI
(Chapter 4: Sec 4.1 to 4.28 of the Text Book)

Text Book:

Near-Rings and their links with groups by J.D.P.Meldrum.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV (Elective)
Paper Code: M4OP4 (2)
THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

U N I T I

System of Linear Differential Equations: Introduction system of First order Equations - Existence and Uniqueness theorem - Fundamental Matrix - Non Homogenous Linear System - Systems with Constant Coefficients – Linear Systems with Periodic Co-efficient
(Chapter 4: Sec 4.1 to 4.7 of Text Book)

U N I T I I

Existence and Uniqueness of Solutions : Introduction – Preliminaries - Successive Approximations - Picard's Theorem - Non Uniqueness of Solutions - Continuation and Dependence on initial conditions - Existence of Solutions in the large - Existence and Uniqueness of Solutions of Systems.
(Chapter 5: Sec. 5.1. to 5.8 of Text Book)

U N I T III

Behavior of Solutions of linear Differential Equations : Introduction - n^{th} order - Elementary Critical Points - Critical Points of Non-Linear system - Linear Systems with Constant-coefficient - Linear Systems with variable Co-efficient - Second Order Linear Differential Equations .
(Chapter 5 & 6 of Text Book)

U N I T IV

Stability Non-Linear systems : Introduction - Stability of Quasi- Linear Systems - Stability of Autonomous Systems - Stability of Non- Autonomous Systems - A special Lyapanov Function
(Chapter 9: Sec 9.1 to 9.5 of Text Book)

Text Book:

Ordinary Diff. Equations and Stability Theory by S.G. Deo, V. Ragvendra and V.Laxmi Kantham.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – IV(Elective)
Paper Code: M4OP4(3)

OPERATIONS RESEARCH

UNIT I:

Sequencing and Scheduling: Sequencing Problem – The Problem of n Jobs and Two Machines – Problem with n Jobs and m Machines – General Problem of n Jobs and m Machines - Scheduling – Critical Path Determination by CPM – Critical Path Determination by PERT – Optimum Scheduling by CPM.
(Chapter 7 of Text Book1)

UNIT II

Queueing Theory – Introduction – Queueing system – Elements of a Queueing system – Operating characteristics of a Queueing system – Deterministic Queueing system – Probability distributions in Queueing systems – Classification of Queueing Models – Definition of Transient and Steady States – Poisson Queueing systems.
(Chapter 21: Sec 21.1 to 21.9 of Text Book 2)

UNIT III

Dynamic Programming – Introduction – The recursive equation approach – Characteristics of Dynamic Programming – Dynamic Programming Algorithm – Solution of L.P.P. by Dynamic Programming.
(Chapter13: Sec 13.1 to 13.4, 13.7 of Text Book 2)

UNIT- IV

Non-Linear Programming – General Non – Linear Programming Problem – Constrained Optimization with Equality Constraints - Constrained Optimization with Inequality Constraints – Non – Linear Programming Methods – Graphical Solution – Quadratic Programming – Wolfe's Modified Simplex Method – Beale's Method.
(Chapter 27: Sec 27.3 to 27.5, Chapter 28:Sec 28.1, 28.2, 28.4 to 28.6 of Text Book 2)

Text Book:

1. Introduction to Optimization Operations Research by J.C. Pant(6^{th} Edition)
2. Operations Research by Kanthi Swarup, P.K.Gupta, Man Mohan, Sultan Chand & Sons

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: M4OP4 (4)

Computational Methods for Partial Differential Equations

UNIT I

Partial Differential Equations – Introduction – Difference Method – Routh Hurwitz Criterion – Domain of Dependence of Hyperbolic Equations.
(Chapter 1: Sec 1.1 to 1.4 of Text Book)

UNIT II

Difference Methods for Parabolic Differential Equations – Introduction – One Space Dimension – Two Space Dimensions – Spherical and Cylindrical Coordinate System.
(Chapter 2: Sec 2.1 to 2.3, 2.5 of Text Book)

UNIT III

Difference Methods for Hyperbolic Partial Differential Equations – One Space Dimensions – Two Space Dimensions – First Order Equations.
(Chapter 3: Sec 3.1 to 3.4 of Text Book)

UNIT- IV

Numerical Methods for Elliptic Partial Differential Equations – Introduction – Difference Methods for Linear Boundary Value Problems – General Second Order Linear Equation – Equation in Polar Coordinates.
(Chapter 4: Sec 4.1 to 4.4 of Text Book)

Text Book :

Computational Methods for Partial Differential Equations by M.K.Jain, S.R.K.Iyengar, R.K.Jain, Wiley Eastern Limited, New Age International Limited, New Delhi

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: M4OP4 (5)

AUTOMATA AND MACHINES

U N I T I

Context - Free Languages : Context – Free languages – Derivation Tress- Ambiguity in Context – Free Grammers – Simplification of Context – Free Grammers – Comosky Normal Form of Context - Free Grammars – Pumping Lemma for context – Free Languages- Decision Algorithms for Context – Free Languages.

U N I T I I

Pushdown Automata : Basic Definitions – Acceptance by Pda – Pushdown Automata and Context Free Languages- Parsing and Push Down Automata.

U N I T III

Turning Machines And Linear Bounded Automata: Turning Machine Model – Representation of Turning Machines – Language Acceptability by Turing Machines – Design of Turing Machines – Universal Turing Machines and their Modifications. The Model of Linear Bounded Automation – Turing Machines and Type O Grammers.

U N I T IV

Linear Bounded Automata and languages – Halting Problem of Turning Machines – NP – Completeness – LR (K) Grammers – Properties of LR(K) Grammars – Closure Properties of Languages.

Text Book:

Theory of Computer Science (Automata, languages and Computation) by KLP Mishra and N.Chandrasekhar, Printice Hall of India.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: M4OP4 (6)
THEORY OF RELIABILITY

UNIT I
Reliability – Definition of Reliability - Failure Data Analysis – Failure data – Mean failure rate – Mean time to failure – Mean time between failures – Graphical plots – MTTF in terms of failure density – Generalization - Reliability in terms of Hazard rate and failure density – Mean time to failure in integral form - Hazard Models: Constant Hazard, Linearly increasing Hazard – The Weibull model – Distribution functions and reliability analysis – Some important distributions - Expected value — Standard deviation and variation.
(Chapter 2, Chapter 3: Sec 3.1 to 3.11, Chapter 4: Sec 4.1 to 4.4, 4.6, 4.7, 4.9, 4.10 of Text Book1)

UNIT II
Interference Theory and Reliability Computations – General expression for reliability – Reliability computation for normally distributed stress and strength – Reliability computation for Log normally distributed stress and strength – Reliability computation for exponentially distributed stress and strength - Reliability computation for normally(exponentially) distributed strength and exponentially(normally) distributed stress - Reliability computation for gamma distributed stress and strength- Reliability computation for weibull distributed stress and strength.
(Chapter 6: Sec 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.8 of Text Book 2)

UNIT III
System Reliability – Series configuration – Parallel configuration – Mixed configuration – Application to specific hazard models – An r-out of –n structure – Methods of solving complex systems – Systems not reducible to mixed configuration - Mean time to failure of systems - Logic diagrams – Markov models – Markov graphs.
(Chapter 6: Sec 6.1 to 6.12 of Text Book 1)

UNIT IV
Reliability improvement – Improvement of components – Redundancy - Element Redundancy - Unit Redundancy - Standby Redundancy.
Maintainability and availability - Maintainability – Availability.
Repairable systems – Instantaneous repair rate – Mean time to repair – Reliability and availability functions.
(Chapter 7: Sec 7.1 to7.6, Chapter 9: Sec 9.1 to 9.3, chapter 10 of Text Book 1)

Text Books:
1. Reliability Engineering by L.S. Srinath, Fourth edition, East-West Press Private Limited.
2. Reliability in Engineering Design by K.C.Kapur, L.R.Lamberson, John Wiley & Sons, Inc.

Reference Books:
Reliability Engineering by E.Balagurusamy, Tata McGraw-Hill Publishing Company Limited.

M4OP5(1)

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: M4OP5 (1)
PROGRAMMING METHODOLOGY

U N I T I

Algorithms – Data-Data types and primitive operations – Variables and Expressions - From Algorithms to Programs Decisions Structures – Looping – Use of Compound conditions – Case Statement Applications

U N I T II

Sub Algorithms – Argument – Parameter Correspondence – Recursive Sub algorithms – Applications composite Date Structures One- Dimensional Arrays – Sorting and Searching with Vectors – Application of Vectors.

U N I T III

Higher – Dimensional Arrays – Application of Arrays – Files – Linear Data Structures – Linear Lists- Storage Structure Concepts – Sequential Storage Structure for Arrays – Application of Stacks – Queues.

U N I T IV

Non-Linear Data Structures – Trees – General Trees – Application of Trees- Graphs.

Text Book :

Introduction to Computer Science by Trembay and Bunt.

Lab Work :

Simple programs in C on the above Structures

Pattern of Lab Training.

The total number of students are made into batches. The number of students in each batch should not more than students and each batch should be handled by two teachers

M4OP5(2)

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: M4OP5 (2)
PROGRAMMING IN C++

U N I T I

Input and Output in C++-C++ Declarative control Structures .
(Chapters 2, 3 and 4 of Text Book)

U N I T I I

Functions in C++ - Classes and Objects.
(Chapters 5 and 6 of Text Book)

U N I T III

Constructors and Destructors – Operator Overloading and Type conversion – Inheritance
(Chapters 7, 8 and 9 of Text Book)

U N I T IV

Pointers and Array – C++ and Memory – Binding , Polymorphism and Virtual Functions
(Chapters 10, 11 and 12 of Text Book)

Text Book:

Object-Oriented Programming with ANSI & Turbo C++ by Ahok. N. Kamthane.

Lab Work:

Simple programs in C ++ on the above topics.

Pattern of Lab Training :

The total number of students are made into batches. The number of students in each batch should not be more than 10 students and each batch should be handled by two teachers.

M4OP5 (3)

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper – V (Elective)
Paper Code: M4OP5 (3)
APPLIED STOCHASTIC PROCESS WITH MAT LAB

UNIT I

Stochastic Process: Some Notations – Introduction - Specifications of Stochastic Process - Stationary process.
(Sec 2.1, 2.2 & 2.3 of Text Book 1)
Markov chains: Definition and Examples - Transition Matrix - Order of Markov chains - Markov chain as graphs - Higher transition probabilities - Classification of States and chains – Irreducible chain - periodic chain - transient and recurrence states - first passage time distributions - stability of Markov system - Stationary distribution - Ergodicity.
(Sec 3.1, 3.2, 3.4, 3.6 of Text Book 1)

UNIT II

Markov Process with Discrete State Space - Poison process - Poisson process and related distributions - Continuous Time Markov Chain (CTMC).
(Sec 4.1, 4.2 & 4.5 of Text Book 1)

UNIT III

Finite Markov Chains and its Applications: Finite Markov chains with recurrent & transient States - Irreducible finite Markov Chains with Ergodic states, statistical inference.
(Sec 5.1, 5.2 & 5.3 of Text Book 2)

UNIT IV

Stationary Process and Time Series : Introduction - Models of time series - Time and frequency domain - Power spectrum Statistical Analysis of Time Series - Some definitions
(Sec 8.1, 8.2, 8.3 & 8.4 of Text Book 1)

Text Book:

1. Stochastic Process by J.Medhi, Second Edition, Wiley Eastern Limited
2. Elements of Applied Stochastic Process by U.N.Bhatt, JohnWiley & Sons

Reference Books:

1. Stochastic Process by N.U. Prabhu, Macmillan, NewYork

PRACTICALS **(20 Marks)**

i) Lab Work (MATLAB)

(**10 Marks**)

1. Basic Matrix operations
2. Computation of Eigen values & Eigen vectors.
3. Computation of steady state probability distribution using
    a. Power method
    b. Jacobi method
    c. Gauss-Seidel method

Reference Books:

1. Getting Started with MATLAB by Rudra Pratap, Oxford University Press.
2. Introduction to Numerical Solutions of Markov Chains by William J. Stewart, Princeton University Press.

ii. Case Studies (**10 Marks)**

Applications of finite Markov Chains in Finance and Banking, Health Care, Retail Business, Internet Traffic Modeling and other research and development areas.

Note: For the case studies, students will be divided into batches. Each batch consists of two or three students.

KAKATIYA UNIVERSITY
M.A. /M.Sc. MATHEMATICS Syllabus (w.e.f.2019-20)
Semester –IV
Paper –IV (Elective)
Paper Code: M4OP4 (6)
THEORY OF RELIABILITY

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(Chapter 2, Chapter 3: Sec 3.1 to 3.11, Chapter 4: Sec 4.1 to 4.4, 4.6, 4.7, 4.9, 4.10 of Text Book1)

UNIT II

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(Chapter 6: Sec 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.8 of Text Book 2)

UNIT III

System Reliability – Series configuration – Parallel configuration – Mixed configuration – Application to specific hazard models – An r-out of –n structure – Methods of solving complex systems – Systems not reducible to mixed configuration - Mean time to failure of systems - Logic diagrams – Markov models – Markov graphs.
(Chapter 6: Sec 6.1 to 6.12 of Text Book 1)

UNIT IV

Reliability improvement – Improvement of components – Redundancy - Element Redundancy - Unit Redundancy - Standby Redundancy.
Maintainability and availability - Maintainability – Availability.
Repairable systems – Instantaneous repair rate – Mean time to repair – Reliability and availability functions.
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2. Reliability in Engineering Design by K.C.Kapur, L.R.Lamberson, John Wiley & Sons, Inc.

Reference Books:

Reliability Engineering by E.Balagurusamy, Tata McGraw-Hill Publishing Company