SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL ANDCHEMICAL SCIENCES

Theory | Credits: 4 | 5 hrs/week

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations

3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles **Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product and problems **Statistical Measures**: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: :

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.
Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

SEMESTER-I

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory | Credits: 4 | 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.

3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point ofintersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product ruleand quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose ofa matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. **Recent advances in the field of nanotechnology**: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah

SEMESTER-II

COURSE 3: DIFFERENTIAL EQUATIONS

Theory | Credits: 4 | 5 hrs/week

Course Outcomes

After successful completion of this course, the student will be able to

1. solve first order first degree linear differential equations.
2. convert a non-exact homogeneous equation to exact differential equation by using an integrating factor.
3. know the methods of finding solution of a differential equation of first order but not of first degree.
4. solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients.
5. understand and apply the appropriate methods for solving higher order differential equations.

Course Content

Unit – 1

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integrating factors - Equations reducible to Exact Equations by Integrating Factors -

i) Inspection Method ii) $\frac{1}{Mx+Ny}$ iii) $\frac{1}{Mx-Ny}$

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

Solutions of homogeneous linear differential equations of order n with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

(i) $Q(x) = e^{ax}$ (ii) $Q(x) = Sin\ ax$ (or) $Cos\ ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x

Unit – 5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving Sessions.

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand &Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

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SEMESTER-II

COURSE 4: ANALYTICAL SOLID GEOMETRY

Theory Credits: 4 5 hrs/week

Course Outcomes

After successful completion of this course, the student will be able to

1. understand planes and system of planes
2. know the detailed idea of lines
3. understand spheres and their properties
4. know system of spheres and coaxial system of spheres
5. understand various types of cones

Course Content

Unit – 1
The Plane

Equation of plane in terms of its intercepts on the axis - Equations of the plane through the given points - Length of the perpendicular from a given point to a given plane - Bisectors of angles between two planes - Combined equation of two planes - Orthogonal projection on a plane.

Unit – 2
The Line

Equation of a line - Angle between a line and a plane - The condition that a given line may lie in a given plane - The condition that two given lines are coplanar - Number of arbitrary constants in the equations of straight line - Sets of conditions which determine a line - The shortest distance between two lines - The length and equations of the line of shortest distance between two straight lines - Length of the perpendicular from a given point to a given line.

Unit – 3
The Sphere

Definition and equation of the sphere - Equation of the sphere through four given points - Plane sections of a sphere - Intersection of two spheres - Equation of a circle - Sphere through a given circle - Intersection of a sphere and a line - Power of a point - Tangent plane - Plane of contact; Polar plane - Pole of a Plane - Conjugate points - Conjugate planes.

Unit – 4
Spheres (continued)

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane; Coaxial system of spheres - Simplified from of the equation of two spheres.

Unit – 5
Cones

Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertex and guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

Activities

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving Sessions.

Text Book

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) , VISAKHAPATNAM

III SEMESTER **MATHEMATICS** **TIME : 3 HRS/WEEK**

M-Mat-3301(3) **Group Theory** **MAX. MARKS : 100**

w.e.f AK 2023-2024 (Admitted batch)SYLLABUS

(Major)

Course Objectives: To enable the students to –

CO1: Recall the definition of a group and its basic properties, Explain the difference between a semigroup, a monoid, and a group, interpret composition tables to understand group operations **(K1 & K2)**

CO2: Verify whether a given subset satisfies the subgroup criteria, Determine whether the intersection or union of two subgroups is also a subgroup, Investigate the properties of cosets and their significance, Explore the implications of Lagrange's Theorem on subgroup sizes. **(K3 & K4)**

CO3: Formulate the definition of a normal subgroup, Differentiate between proper and improper normal subgroups, Assess the impact of normal subgroups on group structure, Analyse the intersection of two normal subgroups. **(K5 & K6)**

CO4: Construct examples of homomorphisms, Investigate the properties of images and kernels. Evaluate the impact of isomorphisms and automorphisms on group structures, Understand the significance of the fundamental theorem on homomorphisms. **(K3 & K4)**

CO5: Recall the definition of permutations and their basic properties, Identify cyclic permutations. Explain the significance of even and odd permutations, Understand the role of Cayley's theorem in group theory. **(K1 & K2)**

Course Outcomes: After successful completion of this course, the student will be able to

CO1: Define a group and explain its fundamental properties, Understand the concept of order within a group, Describe the algebraic structure of a semigroup and a monoid, Explain the composition tables for groups **(K1 & K2)**

CO2: Determine whether a given subset is a subgroup of a group, Apply the criterion for the product of two subgroups to be a subgroup, Analyse the properties of cosets and their relationship to subgroups, Calculate the index of a subgroup using Lagrange's Theorem. **(K3 & K4)**

CO3: Define a normal subgroup and distinguish between proper and improper normal subgroups, Apply the criterion for a subgroup to be normal, Evaluate the intersection of two normal subgroups, Understand the concept of normal subgroups in group theory. **(K5 & K6)**

CO4: Define a homomorphism between groups, Understand the image and kernel of a Homomorphism, Explore the properties of isomorphisms and automorphisms, Apply the

fundamental theorem on homomorphisms. (K3 & K4)

CO5: Define permutations and understand their multiplication, Explain the concept of cyclic permutations, Differentiate between even and odd permutations, State Cayley's theorem. (K1 & K2)

Course Content:

Unit – 1

Groups:

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Unit – 2:

Sub Groups

Complex Definition – Multiplication of two complexes - Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups-Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – Properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

Unit – 3:

Normal Subgroups:

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups, Sub group of index 2 is a normal sub group

Unit – 4 :

Homomorphisms:

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Unit – 5:

Permutations and Cyclic Groups:

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Group Theory to Real life Problem /Problem Solving Sessions.

Text Book:

Modern Algebra by A.R. Vasishtha and A.K. Vasishtha, Krishna Prakashan Media Pvt. Ltd., Meerut.

Reference Books:

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER MATHEMATICS Time: 2hrs/week

M-Mal-3351(2) GROUP THEORY Marks:50

w.e.f AK 2023-2024 (Admitted batch)

PRACTICAL SYLLABUS

Course Objectives: To enable the students to –

CO1: Recall the definition of a group and its basic properties, Explain the difference between a semigroup, a monoid, and a group, interpret composition tables to understand group operations **(K1 & K2)**

CO2: Verify whether a given subset satisfies the subgroup criteria, Determine whether the intersection or union of two subgroups is also a subgroup, Investigate the properties of cosets and their significance, Explore the implications of Lagrange's Theorem on subgroup sizes. **(K3 & K4)**

CO3: Formulate the definition of a normal subgroup, Differentiate between proper and improper normal subgroups, Assess the impact of normal subgroups on group structure, Analyse the intersection of two normal subgroups. **(K5 & K6)**

CO4: Construct examples of homomorphisms, Investigate the properties of images and kernels. Evaluate the impact of isomorphisms and automorphisms on group structures, Understand the significance of the fundamental theorem on homomorphisms. **(K3 & K4)**

CO5: Recall the definition of permutations and their basic properties, Identify cyclic permutations. Explain the significance of even and odd permutations, Understand the role of Cayley's theorem in group theory. **(K1 & K2)**

Course Outcomes: After successful completion of this course, the student will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical and Draw meaningful solutions to day-to-day problems

CO2: Define a group and explain its fundamental properties, Understand the concept of order within a group, Describe the algebraic structure of a semigroup and a monoid, Explain the composition tables for groups **(K1 & K2)**

CO3: Determine whether a given subset is a subgroup of a group, Apply the criterion for the product of two subgroups to be a subgroup, Analyse the properties of cosets and their relationship to subgroups, Calculate the index of a subgroup using Lagrange's Theorem. **(K3 & K4)**

CO4: Define a normal subgroup and distinguish between proper and improper normal subgroups, Apply the criterion for a subgroup to be normal, Evaluate the intersection of two normal

subgroups, Understand the concept of normal subgroups in group theory. **(K5 & K6)**

CO5: Define a homomorphism between groups, Understand the image and kernel of a Homomorphism, Explore the properties of isomorphisms and automorphisms, Apply the fundamental theorem on homomorphisms. **(K3 & K4)**

CO6: Define permutations and understand their multiplication, Explain the concept of cyclic permutations, Differentiate between even and odd permutations, State Cayley's theorem. **(K1 & K2)**

Course Content:

Unit – 1

Groups:

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Unit – 2:

Sub Groups

Complex Definition – Multiplication of two complexes - Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups-Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – Properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

Unit – 3:

Normal Subgroups:

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups, Sub group of index 2 is a normal sub group

Unit – 4 :

Homomorphisms:

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Unit – 5:

Permutations and Cyclic Groups:

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic

permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Group Theory to Real life Problem /Problem Solving Sessions.

Text Book:

Modern Algebra by A.R. Vasishtha and A.K. Vasishtha, Krishna Prakashan Media Pvt. Ltd., Meerut.

Reference Books:

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER | MATHEMATICS | TIME : 3 HRS/WEEK

M-Ma2-3302(3) | NUMERICAL METHODS | MAX. MARKS : 100

w.e.f AK 2023-2024 (Admitted batch)**SYLLABUS**

(Major)

Course Objectives: To enable the students to –

CO1: Apply the concept of finite differences to express any function value in terms of leading terms and differences, Utilize the E and D operators to manipulate finite differences, Investigate the properties of factorial notation and its role in expressing missing terms, Analyse the relations between Δ, ∇ , and E operators. **(K3 & K4)**

CO2: Derive Newton–Gregory forward and backward interpolation formulas, Solve interpolation problems with equal and unequal intervals, Explore the concept of divided differences and their significance, Understand the properties of Lagrange's interpolation. **(K3 & K4)**

CO3: Compute central difference operators such as (δ\delta), (μ \mu), and (σ\sigma), Apply Gauss forward formula for equal intervals, Investigate the practical implications of Stirling's and Bessel's formulas, Understand the relationship between central difference operators.**(K3 & K4)**

CO4: Determine an initial approximate value for solving algebraic and transcendental equations, Implement bisection method, Regula Falsi method, and Newton–Raphson method, Evaluate the efficiency and accuracy of different root-finding techniques, Understand the convergence behavior of iterative methods. **(K3 & K4)**

CO5: Apply least-squares curve fitting procedures, Fit data using a straight line and explore nonlinear curve fitting, Construct curve fits by combining sums of exponentials, Develop practical skills in curve fitting. **(K3 & K6)**

Course Outcomes: Students will be able to

CO1: Express function values using finite differences, Understand the fundamental theorem of difference calculus. **(K3 & K4)**

CO2: Implement Newton–Gregory interpolation techniques, Utilize divided differences and

Lagrange's method for interpolation. (K3 & K4)

CO3: Calculate central difference operators and apply them in interpolation, Utilize Gauss forward and backward formulas. (K3 & K4)

CO4: Solve given equations using bisection, Regula Falsi, and Newton–Raphson methods.(K3 & K4)

CO5: Perform least-squares fitting for various types of data. (K3)

Course Content:

Unit – I: The Calculus of Finite Differences:

The operators Δ, ∇, E - Fundamental theorem of difference calculus- properties of Δ, ∇, E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

Unit – II: Interpolation with Equal and Unequal Intervals:

Derivations of Newton – Gregory Forward and backward interpolation and problems on them - Divided differences, Newton divided difference formula, Lagrange's and problems on them.

Unit – 3: Central Difference Interpolation formulae:

Central Difference operators δ, μ, σ and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirling's formula - Bessel's formula and problems on the above formulae.

Unit – 4: Solution of Algebraic and Transcendental Equation:

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5: Curve Fitting:

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials

Activities:

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book:

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7th Edition
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER MATHEMATICS TIME: 2 HRS/WEEK

M-Ma2-3352(3) NUMERICAL METHODS MAX. MARKS: 50

w.e.f AK 2023-2024 (Admitted batch) **PRACTICAL SYLLABUS**

(Major)

Course Objectives: To enable the students to –

CO1: Apply the concept of finite differences to express any function value in terms of leading terms and differences, Utilize the E and D operators to manipulate finite differences, Investigate the properties of factorial notation and its role in expressing missing terms, Analyse the relations between Δ, ∇ , and E operators. **(K3 & K4)**

CO2: Derive Newton–Gregory forward and backward interpolation formulas, Solve interpolation problems with equal and unequal intervals, Explore the concept of divided differences and their significance, Understand the properties of Lagrange's interpolation. **(K3 & K4)**

CO3: Compute central difference operators such as (δ\delta), (μ \mu), and (σ\sigma), Apply Gauss forward formula for equal intervals, Investigate the practical implications of Stirling's and Bessel's formulas, Understand the relationship between central difference operators. **(K3 & K4)**

CO4: Determine an initial approximate value for solving algebraic and transcendental equations, Implement bisection method, Regula Falsi method, and Newton–Raphson method, Evaluate the efficiency and accuracy of different root-finding techniques, Understand the convergence behavior of iterative methods. **(K3 & K4)**

CO5: Apply least-squares curve fitting procedures, Fit data using a straight line and explore nonlinear curve fitting, Construct curve fits by combining sums of exponentials, Develop practical skills in curve fitting. **(K3 & K6)**

Course Outcomes: Students will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in variouscourses of B.Sc to solve numericalproblems based on real life situationsduringpracticalsand drawmeaningful solutions to day-to-dayproblems

CO2: Express function values using finite differences, Understand the fundamental theorem of

difference calculus. (K3 & K4)

CO3: Implement Newton–Gregory interpolation techniques, Utilize divided differences and Lagrange's method for interpolation. (K3 & K4)

CO4: Calculate central difference operators and apply them in interpolation, Utilize Gauss forward and backward formulas. (K3 & K4)

CO5: Solve given equations using bisection, Regula Falsi, and Newton–Raphson methods.(K3 & K4)

CO6: Perform least-squares fitting for various types of data. (K3)

Course Content:

Unit – I: The Calculus of Finite Differences:

The operators Δ, ∇, E - Fundamental theorem of difference calculus- properties of Δ, ∇, E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

Unit – II: Interpolation with Equal and Unequal Intervals:

Derivations of Newton – Gregory Forward and backward interpolation and problems on them - Divided differences, Newton divided difference formula, Lagrange's and problems on them.

Unit – 3: Central Difference Interpolation formulae:

Central Difference operators δ, μ, σ and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirling's formula - Bessel's formula and problems on the above formulae.

Unit – 4: Solution of Algebraic and Transcendental Equation:

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5: Curve Fitting:

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials

Activities:

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book:

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7th Edition
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER MATHEMATICS Time:3Hrs/Week

M-Ma3-3303(3) LAPLACE TRANSFORMS Marks:100

w.e.f AK 2023-2024 (Admitted Batch) SYLLABUS

Course Objectives: To enable the students to –

CO1: Apply the definition of Laplace transform to transform functions from the time domain to the Laplace domain, Utilize the linearity property of Laplace transforms. **(K3)**

CO2: Apply the shifting theorems and change of scale property in Laplace transforms, Utilize Laplace transforms to find derivatives and evaluate initial and final values. **(K3)**

CO3: Compute Laplace transforms of integrals and functions involving multiplication by (t) and (t^n), Understand the Laplace transforms of special functions such as Bessel functions, error functions, and sine/cosine integrals. **(K2 & K3)**

CO4: Utilize the inverse Laplace transform to transform functions back from the Laplace domain to the time domain, Apply the shifting theorems and change of scale property in inverse Laplace transforms. **(K3)**

CO5: Compute inverse Laplace transforms of derivatives and integrals, Understand the concept of convolution and its application in inverse Laplace transforms. **(K3)**

Course Outcomes:After successful completion of this course, the student will be able to

CO1: Compute Laplace transforms for piecewise continuous functions, Determine the existence of Laplace transforms for functions of exponential order. **(K3)**

CO2: Use Laplace transforms to analyse shifted and scaled functions, Apply the initial value theorem and final value theorem. **(K3 & K4)**

CO3: Evaluate Laplace transforms involving integrals and special functions, Apply Laplace transforms to solve problems related to Bessel functions and other special functions. **(K3 & K5)**

CO4: Compute inverse Laplace transforms using partial fractions and shifting theorems, solve problems related to inverse Laplace transforms **(K3)**

CO5: Evaluate inverse Laplace transforms involving derivatives and integrals, Apply the convolution theorem and Heaviside's expansion theorem. **(K3 & K5)**

Course Content:

Unit – I: LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

Unit – II: LAPLACE TRANSFORMS – II

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace transform of the derivative of f(t), Initial value theorem and Final value theorem.

Unit – III: LAPLACE TRNASFORM – III

Laplace Transform of Integrals - Multiplication by t, Multiplication by tn - division by t - Laplace transform of Bessel Function - Laplace Transform of Error Function - Laplace transform of Sine and Cosine integrals.

Unit – IV: INVERSE LAPLACE TRANSFORMS – I

Definition of Inverse Laplace Transform - Linearity Property - First Shifting Theorem - Second Shifting Theorem - Change of Scale property - use of partial fractions - Examples.

Unit – V: INVERSE LAPLACE TRANSFORMS – II

Inverse Laplace transforms of Derivatives - Inverse Laplace Transforms of Integrals - Multiplication by Powers of 'p' - Division by powers of 'p' - Convolution Definition - Convolution Theorem - proof and Applications - Heaviside's Expansion theorem and its applications.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Laplace Transforms to Real life Problem /Problem Solving Sessions.

Text Book:

LaPlace Transforms by A. R. Vasishtha, Dr. R. K. Gupta, Krishna Prakashan Media Pvt. Ltd., Meerut.

Reference Books:

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fourie's transforms by Dr. J. K. Goyal and K.P. Guptha, Pragathi Prakashan, Meerut.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER MATHEMATICS Time:2 Hrs/Week

M-Ma3-3353(3) LAPLACE TRANSFORMS Marks:50

w.e.f AK 2023-2024 (Admitted Batch) PRACTICAL SYLLABUS

Course Objectives: To enable the students to –

CO1: Apply the definition of Laplace transform to transform functions from the time domain to the Laplace domain, Utilize the linearity property of Laplace transforms. **(K3)**

CO2: Apply the shifting theorems and change of scale property in Laplace transforms, Utilize Laplace transforms to find derivatives and evaluate initial and final values. **(K3)**

CO3: Compute Laplace transforms of integrals and functions involving multiplication by (t) and (t^n), Understand the Laplace transforms of special functions such as Bessel functions, error functions, and sine/cosine integrals. **(K2 & K3)**

CO4: Utilize the inverse Laplace transform to transform functions back from the Laplace domain to the time domain, Apply the shifting theorems and change of scale property in inverse Laplace transforms. **(K3)**

CO5: Compute inverse Laplace transforms of derivatives and integrals, Understand the concept of convolution and its application in inverse Laplace transforms. **(K3)**

Course Outcomes: After successful completion of this course, the student will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical and draw meaningful solutions to day-to-day problems. **(K3)**

CO2: Compute Laplace transforms for piecewise continuous functions, Determine the existence of Laplace transforms for functions of exponential order. **(K3)**

CO3: Use Laplace transforms to analyse shifted and scaled functions, Apply the initial value theorem and final value theorem. **(K3 & K4)**

CO4: Evaluate Laplace transforms involving integrals and special functions, Apply Laplace transforms to solve problems related to Bessel functions and other special functions. **(K3 & K5)**

CO5: Compute inverse Laplace transforms using partial fractions and shifting theorems, solve problems related to inverse Laplace transforms **(K3)**

CO6: Evaluate inverse Laplace transforms involving derivatives and integrals, Apply the convolution theorem and Heaviside's expansion theorem. **(K3 & K5)**

Course Content:

Unit – I: LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

Unit – II: LAPLACE TRANSFORMS – II

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace transform of the derivative of f(t), Initial value theorem and Final value theorem.

Unit – III: LAPLACE TRNASFORM – III

Laplace Transform of Integrals - Multiplication by t, Multiplication by tn - division by t - Laplace transform of Bessel Function - Laplace Transform of Error Function - Laplace transform of Sine and Cosine integrals.

Unit – IV: INVERSE LAPLACE TRANSFORMS – I

Definition of Inverse Laplace Transform - Linearity Property - First Shifting Theorem - Second Shifting Theorem - Change of Scale property - use of partial fractions - Examples.

Unit – V: INVERSE LAPLACE TRANSFORMS – II

Inverse Laplace transforms of Derivatives - Inverse Laplace Transforms of Integrals - Multiplication by Powers of 'p' - Division by powers of 'p' - Convolution Definition - Convolution Theorem - proof and Applications - Heaviside's Expansion theorem and its applications.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Laplace Transforms to Real life Problem /Problem Solving Sessions.

Text Book:

LaPlace Transforms by A. R. Vasishtha, Dr. R. K. Gupta, Krishna Prakashan Media Pvt. Ltd., Meerut.

Reference Books:

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fourie's transforms by Dr. J. K. Goyal and K.P. Guptha, Pragathi Prakashan, Meerut.

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER MATHEMATICS TIME: 3Hrs/Week

M-Ma4-3304(3) SPECIAL FUNCTIONS Max.Marks:100

w.e.f AK 2023-2024 (Admitted Batch) SYLLABUS

Course Objectives: To enable the students to

CO1: Understand Euler's integrals and their connection to beta and gamma functions, Explore elementary properties of gamma functions and their transformations, Investigate Chebyshev polynomials, including their orthogonal properties and recurrence relations.

CO2: Define Legendre polynomials and their significance, Solve Legendre's equation and compute Legendre polynomials of degree 'n', Explore the generating function of Legendre polynomials.

CO3: Study Hermite differential equations and their solutions, Compute Hermite polynomials and understand their generating function, Investigate the orthogonal properties and recurrence formulas for Hermite polynomials.

CO4: Define Bessel's equation and its solutions, Explore Bessel functions of the first and second kinds for various orders, Understand the integration of Bessel's equation in series and the recurrence formulas for Bessel functions.

CO5: Learn about power series and their properties, including the radius of convergence, Introduce power series solutions for ordinary differential equations, Distinguish between ordinary and singular points, regular and irregular singular points, and their impact on power series solutions.

Course Outcomes: Students after successful completion of the course will be able to:

CO1: Understand the Beta and Gamma functions, their properties and relation between These two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations. **(Unit-I: K2 & K4)**

CO2: Solve Legendre equation and write the Legendre equation of first kind, also Find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials. **(Unit-II: K3 & K4)**

CO3: Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also Find the generating function for Hermite Polynomials, study the orthogonal

properties of Hermite Polynomials and recurrence relations.

(Unit-III: K3 & K4)

CO4: Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function. **(Unit-IV: K3 & K4)**

CO5: Find power series solutions of ordinary differential equations. **(Unit-V: K3)**

Course Syllabus

Unit–1: Beta and Gamma functions, Chebyshev polynomials

1. Euler's Integrals - Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.
3. Chebyshev polynomials, Orthogonal properties of Chebyshev polynomials, Recurrence relations, Generating functions for Chebyshev polynomials.

(Chapter 2.9 – 2.15 and 8.1 – 8.8)

Unit–2: Legendre polynomials

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree 'n', Generating function of Legendre polynomials.
2. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n, in the expansion of $(1-2xh+h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials, Rodrigue's formula for Legendre's Polynomials.

(Chapter 2.1 – 2.5 and 2.7, 2.8 & 2.12)

UNIT–3: Hermite Polynomials:

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, Generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

(Chapter 6.1 – 6.8)

UNIT–4: Bessel's Equation:

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of

order 'n', Bessel's function of the second kind of order 'n'.

2. Integration of Bessel's equation in series for m=0, Definition of $J_n(x)$, Recurrence formulae for $J_n(x)$.
3. Generating function for $J_n(x)$, Orthogonally of Bessel's functions.

(Chapter 5.1 – 5.7)

UNIT–5: Power Series and Power Series Solutions of Ordinary Differential Equations:

1. Introduction, summary of useful results, power series, some important facts about the power series, radius of convergence
2. Introduction of power series solutions of ordinary differential equation
3. Ordinary and singular points, regular and irregular singular points, power series solution.

(Chapter 7.1 – 7.7 and 8.1 to 8.4)

II. Prescribed textbook

1. J.N.Sharma and Dr.R.K.Gupta, Special functions, Krishna Prakashan Media(P) Ltd. **(Unit-1 to Unit - 4)**
2. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S.Chand&Company Pvt. Ltd., Ram Nagar, New Delhi-110055. **(Unit – 5)**

Reference Books:

1. Shanti Narayan and Dr.P.K.Mittal ,Integral Calculus, S.Chand& Company Pvt.Ltd.,Ram Nagar, New Delhi-110055.
2. George F.Simmons, Differential equations with Applications and Historical Notes, Tata McGRAW-Hill Edition,1994.
3. Shepley L.Ross, Differential equations, Second Edition, JohnWilly &Sons, NewYork, 1974.
4. Web resources suggested by the teacher and college librarian including reading material.

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER MATHEMATICS TIME: 3Hrs/Week

M-Ma4-3304(3) SPECIAL FUNCTIONS Max.Marks:50

w.e.f AK 2023-2024 (Admitted Batch) **PRACTICAL SYLLABUS**

Course Objectives:

To enable the students to

CO1: Understand Euler's integrals and their connection to beta and gamma functions, Explore elementary properties of gamma functions and their transformations, Investigate Chebyshev polynomials, including their orthogonal properties and recurrence relations.

CO2: Define Legendre polynomials and their significance, Solve Legendre's equation and compute Legendre polynomials of degree 'n', Explore the generating function of Legendre polynomials.

CO3: Study Hermite differential equations and their solutions, Compute Hermite polynomials and understand their generating function, Investigate the orthogonal properties and recurrence formulas for Hermite polynomials.

CO4: Define Bessel's equation and its solutions, Explore Bessel functions of the first and second kinds for various orders, Understand the integration of Bessel's equation in series and there recurrence formulas for Bessel functions.

CO5: Learn about power series and their properties, including the radius of convergence, Introduce power series solutions for ordinary differential equations, Distinguish between ordinary and singular points, regular and irregular singular points, and their impact on power series solutions.

Course Outcomes: Students after successful completion of the course will be able to:

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical and Draw meaningful solutions to day-to-day problems

CO2: Understand the Beta and Gamma functions, their properties and relation between These two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations. **(Unit-I: K2 & K4)**

CO3: Solve Legendre equation and write the Legendre equation of first kind, also Find the generating function for Legendre Polynomials, understand the

Orthogonal properties of Legendre Polynomials. **(Unit-II: K3 & K4)**

CO4: Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations. **(Unit-III: K3 & K4)**

CO5: Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function.**(Unit-IV: K3 & K4)**

CO6: Find power series solutions of ordinary differential equations. **(Unit-V: K3)**

Course Syllabus

Unit–1: Beta and Gamma functions, Chebyshev polynomials

1. Euler's Integrals - Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.
3. Chebyshev polynomials, Orthogonal properties of Chebyshev polynomials, Recurrence relations, Generating functions for Chebyshev polynomials.

(Chapter 2.9 – 2.15 and 8.1 – 8.8)

Unit–2: Legendre polynomials

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree 'n', Generating function of Legendre polynomials.
2. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n, in the expansion of $(1-2xh+h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials, Rodrigue's formula for Legendre's Polynomials.

(Chapter 2.1 – 2.5 and 2.7, 2.8 & 2.12)

UNIT–3: Hermite Polynomials:

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, Generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

(Chapter 6.1 – 6.8)

UNIT–4: Bessel's Equation:

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order 'n', Bessel's function of the second kind of order 'n'.
2. Integration of Bessel's equation in series for m=0, Definition of $J_n(x)$, Recurrence formulae for $J_n(x)$.
3. Generating function for $J_n(x)$, Orthogonally of Bessel's functions.

(Chapter 5.1 – 5.7)

UNIT–5: Power Series and Power Series Solutions of Ordinary Differential Equations:

1. Introduction, summary of useful results, power series, some important facts about the power series, radius of convergence
2. Introduction of power series solutions of ordinary differential equation
3. Ordinary and singular points, regular and irregular singular points, power series solution.

(Chapter 7.1 – 7.7 and 8.1 to 8.4)

Prescribed textbook:

1. J.N.Sharma and Dr.R.K.Gupta, Special functions, Krishna Prakashan Media(P) Ltd. **(Unit-1 to Unit - 4)**
2. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S.Chand &Company Pvt. Ltd., Ram Nagar, New Delhi-110055. **(Unit – 5)**

Reference Books:

1. Shanti Narayan and Dr.P.K.Mittal ,Integral Calculus, S.Chand& Company Pvt.Ltd.,Ram Nagar, New Delhi-110055.
2. George F.Simmons, Differential equations with Applications and Historical Notes, Tata McGRAW-Hill Edition,1994.
3. Shepley L.Ross, Differential equations, Second Edition, John Willy &Sons, NewYork, 1974.
4. Web resources suggested by the teacher and college librarian including reading material.

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER MATHEMATICS

MULTI-DISCIPLINARY COURSE TIME: 2Hrs/Week

BASIC MATHEMATICS Max.Marks:50

w.e.f AK 2023-2024 (Admitted Batch) SYLLABUS

Course Outcomes

After successful completion of this course, the student will be able to

CO1: understand the concept of sets and relations

CO2: know the method of rationalisation in surds

CO3: understand Co-ordinate system and Locus

CO4: find the Point of intersection of two straight lines

CO5: find the Rank of a matrix.

Course Content:

Unit – I:Algebra

Sets and Relations: Sets – Finite and Infinite sets – Equality of sets – Subsets – Power set – Universal set – Union and Intersection of sets – Relations – Equivalence relations –Examples.

Surds: Surd – Pure and Mixed surds – Similar surds – Monomial surds – Binomial Surds – Rationalisation.

Logarithms: Definition – Properties of Logarithms – Common Logarithms.

Unit – II:Co-ordinate Geometry

Co-ordinate system: Distance between two points – Division formula – Centroid – Areas of Triangles and Quadrilaterals.

Locus: Definition of Locus – Equation of Locus

Straight Line: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

Unit – III:Matrices

Matrices: Types of matrices – Examples – Addition of Matrices – Subtraction of Matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants – Minors and Cofactors – Adjoint of a matrix – Inverse of a matrix – Rank of a matrix – definition and examples.

Activities:

Seminar/ Quiz/ Assignments/ Problem Solving Sessions.

Reference Books:

1. Basic Abstract Algebra by P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul, Cambridge University Press.
2. Co-ordinate Geometry by M.L.Khanna, Jai Prakash Nath Publications.
3. A Text book of Matrices by Shanti Narayan & PK Mittal, S.Chand Publications.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER | MATHEMATICS | TIME: 3Hrs/Week

M-Mat-4301(3) | RING THEORY | Max.Marks:100

w.e.f AK 2023-2024 (Admitted Batch) | SYLLABUS

Course Objectives: To enable the students to

CO1: Apply the definition of a ring and recognize examples of rings, Understand the basic properties of rings, including Boolean rings and fields. **(K3)**

CO2: Analyze the necessary and sufficient conditions for a subset to be a sub ring, Understand the algebraic properties of sub rings and the concept of the center of a ring. **(K4)**

CO3: Apply the concept of a principal ideal ring (PID). Understand the construction of quotient rings and cosets. **(K3)**

CO4: Analyse the properties of homomorphisms of rings, Understand the concepts of kernel, isomorphism, and prime ideals. **(K4)**

CO5: Apply the concept of polynomials in an indeterminate, Understand the division algorithm in the ring of polynomials. **(K2 & K3)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Identify and classify examples of rings and fields, Demonstrate an understanding of the cancellation laws and divisors of 0 in rings. **(K3)**

CO2: Determine whether a given subset forms a subring, Explore the properties of sub rings and their relationship to the center of a ring. **(K4)**

CO3: Identify principal ideals and recognize examples of PIDs., Construct composition tables for finite quotient rings. **(K3)**

CO4: Evaluate homomorphisms between rings, Apply the fundamental theorems related to homomorphisms. **(K4 & K6)**

CO5: Perform polynomial operations and understand irreducible polynomials, Explore the ideal structure in rings of polynomials. **(K2 & K3)**

Course Content:

Unit – I:

Rings and Fields:

Definition of a ring and Examples –Basic properties – Boolean rings - Fields – Divisors of 0 and Cancellation Laws– Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field – Non-commutative Rings - Matrices over a field – The Quaternion ring.

Unit – II:

Subrings and Ideals:

Definition and examples of Sub rings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – Centre of a ring – left, right and two-sided ideals – Algebra of ideals – Equivalence of a field and a commutative ring without proper ideals

Unit-III:

Principal ideals and Quotient Rings:

Definition of a Principal ideal ring (Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings – Construction of composition tables for finite quotient rings of the ring Z of integers and the ring Zn of integers modulo

Unit – IV:

Homomorphism of Rings:

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields

Unit – V:

Rings of Polynomials:

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in $F[x]$ – Irreducible Polynomials – Ideal Structure in $F[x]$ – Uniqueness of Factorization $F[x]$.

Activities: Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

Text book:

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

Reference books:

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.

2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER | MATHEMATICS | TIME: 2Hrs/Week

M-Ma1-4351(2) | RING THEORY | Max. Marks: 50

w.e.f AK 2023-2024 (Admitted Batch) | PRACTICAL SYLLABUS

Course Objectives: To enable the students to

CO1: Apply the definition of a ring and recognize examples of rings, Understand the basic properties of rings, including Boolean rings and fields. **(K3)**

CO2: Analyze the necessary and sufficient conditions for a subset to be a subring, Understand the algebraic properties of subrings and the concept of the center of a ring. **(K4)**

CO3: Apply the concept of a principal ideal ring (PID). Understand the construction of quotient rings and cosets. **(K3)**

CO4: Analyse the properties of homomorphisms of rings, Understand the concepts of kernel, isomorphism, and prime ideals. **(K4)**

CO5: Apply the concept of polynomials in an indeterminate, Understand the division algorithm in the ring of polynomials. **(K2 & K3)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical and Draw meaningful solutions to day-to-day problems

CO2: Identify and classify examples of rings and fields, Demonstrate an understanding of the cancellation laws and divisors of 0 in rings. **(K3)**

CO3: Determine whether a given subset forms a subring, Explore the properties of subrings and their relationship to the center of a ring. **(K4)**

CO4: Identify principal ideals and recognize examples of PIDs., Construct composition tables for finite quotient rings. **(K3)**

CO5: Evaluate homomorphisms between rings, Apply the fundamental theorems related to homomorphisms. **(K4 & K6)**

CO6: Perform polynomial operations and understand irreducible polynomials, Explore the ideal structure in rings of polynomials. **(K2 & K3)**

Course Content:

Unit – I:

Rings and Fields:

Definition of a ring and Examples –Basic properties – Boolean rings - Fields – Divisors of 0 and Cancellation Laws– Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field – Non-commutative Rings - Matrices over a field – The Quaternion ring.

Unit – II:

Subrings and Ideals:

Definition and examples of Subrings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – Centre of a ring – left, right and two-sided ideals – Algebra of ideals – Equivalence of a field and a commutative ring without proper ideals

Unit-III:

Principal ideals and Quotient Rings:

Definition of a Principal ideal ring (Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings – Construction of composition tables for finite quotient rings of the ring Z of integers and the ring Zn of integers modulo

Unit – IV:

Homomorphism of Rings:

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields

Unit – V:

Rings of Polynomials:

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in $F[x]$ – Irreducible Polynomials – Ideal Structure in $F[x]$ – Uniqueness of Factorization $F[x]$.

Activities: Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

Text book:

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

Reference books:

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.

2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER MATHEMATICS TIME: 3Hrs/Week

M-Mal-4301(3) REAL ANALYSIS Max.Marks:100

w.e.f AK 2023-2024 (Admitted Batch) SYLLABUS

Course Objectives: To enable the students to

CO1: Analyse the algebraic and order properties of the set of real numbers, Understand the concept of completeness and its applications in real analysis. **(K2 & K4)**

CO2: Apply the concept of convergence of series, Understand the tests for convergence, including the P-test and nth root test. **(K3)**

CO3: Analyse the limits of real-valued functions, Understand the concept of infinite limits and limits at infinity. **(K4)**

CO4: Apply the concept of derivability of a function at a point and on an interval, Understand the significance of mean value theorems (Rolle's Theorem, Lagrange's Theorem, and Cauchy's Mean Value Theorem). **(K2 & K3)**

CO5: Analyse the concept of Riemann integral and integral functions, Understand the properties of integrable functions and the fundamental theorem of integral calculus. **(K2 & K4)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Apply the supremum property to intervals, Explore the properties of sequences, including boundedness and convergence. **(K3)**

CO2: Determine whether a series converges or diverges, Apply the Leibnitz Test to alternating series. Course Contents **(K3)**

CO3: Evaluate limits of functions, Explore the continuity of functions on intervals and understand uniform continuity. **(K6)**

CO4: Compute derivatives and explore the relationship between continuity and derivability. Apply mean value theorems to analyse functions. **(K3 & K4)**

CO5: Determine the integrability of functions using necessary and sufficient conditions, Apply the Riemann integral to compute areas and explore mean value theorems. **(K3)**

Course Content:

Unit – I:

REALNUMBERS, REAL SEQUENCES:

The algebraic and order properties of R - Absolute value and Real line - Completeness property of R -

Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits -Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence -The Cauchy's criterion - properly divergent sequences - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence -Sub sequences and the Bolzano-Weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

Unit – II:

INFINITIE SERIES:

Introduction to series -convergence of series -Cauchy's general principle of convergence for series tests for convergence of series - Series of non-negative terms - P-test - Cauchy's nth root test -D' Alembert's Test-Alternating Series–Leibnitz Test.

Unit –III:

LIMIT & CONTINUITY:

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion). Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

Unit – IV:

DIFFERENTIATION AND MEAN VALUE THEORMS:

The derivability of a function at a point and on an interval - Derivability and continuity of a function -Mean value Theorems -Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

Unit – V:

RIEMANN INTEGRATION :

Riemann Integral - Riemann integral functions - Darboux theorem -Necessary and Sufficient condition for R integrability - Properties of integrable functions - Fundamental theorem of integral calculus - integral as the limit of a sum - Mean value Theorems.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Real Analysis to Real life Problem /Problem Solving Sessions.

Text Book: A Text Book of B.Sc Mathematics Real Analysis (IV Semester) by Authors : V. VENKATESWARA RAO, Dr. R. BHARAVI SHARMA, B.V.S.S. SARMA, N. KRISHNAMURTHY, S. ANJANEYA SASTRY & S. Ranganatham – S Chand Publications

Reference Books:

1. Elements of Real Analysis by Shanthi Narayan and Dr. M. D. Raisinghania, S. Chand & Company Pvt. Ltd., New Delhi.
2. Principles of Mathematical Analysis by Walter Rudin, McGraw-Hill Ltd.
3. An Introduction to Real Analysis by Robert G. Bartle and Donlad R. Sherbert, John Wiley and sons Pvt. Ltd

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER MATHEMATICS TIME: 2Hrs/Week

M-Ma2-4351(2) REAL ANALYSIS Max.Marks:50

w.e.f AK 2023-2024 (Admitted Batch) PRACTICAL SYLLABUS

Course Objectives: To enable the students to

CO1: Analyse the algebraic and order properties of the set of real numbers, Understand the concept of completeness and its applications in real analysis. **(K2 & K4)**

CO2: Apply the concept of convergence of series, Understand the tests for convergence, including the P-test and nth root test. **(K3)**

CO3: Analyse the limits of real-valued functions, Understand the concept of infinite limits and limits at infinity. **(K4)**

CO4: Apply the concept of derivability of a function at a point and on an interval, Understand the significance of mean value theorems (Rolle's Theorem, Lagrange's Theorem, and Cauchy's Mean Value Theorem). **(K2 & K3)**

CO5: Analyse the concept of Riemann integral and integral functions, Understand the properties of integrable functions and the fundamental theorem of integral calculus. **(K2 & K4)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical and Draw meaningful solutions to day-to-day problems

CO2: Apply the supremum property to intervals, Explore the properties of sequences, including boundedness and convergence. **(K3)**

CO3: Determine whether a series converges or diverges, Apply the Leibnitz Test to alternating series. Course Contents **(K3)**

CO4: Evaluate limits of functions, Explore the continuity of functions on intervals and understand uniform continuity. **(K6)**

CO5: Compute derivatives and explore the relationship between continuity and derivability. Apply mean value theorems to analyse functions. **(K3 & K4)**

CO6: Determine the integrability of functions using necessary and sufficient conditions, Apply the Riemann integral to compute areas and explore mean value theorems. **(K3)**

Course Content:

Unit – I:

REALNUMBERS AND REAL SEQUENCES:

The algebraic and order properties of R - Absolute value and Real line - Completeness property of R - Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits -Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence -The Cauchy's criterion - properly divergent sequences - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence -Sub sequences and the Bolzano-Weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

Unit – II:

INFINITIE SERIES:

Introduction to series -convergence of series -Cauchy's general principle of convergence for series tests for convergence of series - Series of non-negative terms - P-test - Cauchy's nth root test -D' Alembert's Test-Alternating Series–Leibnitz Test.

Unit –III:

LIMIT & CONTINUITY:

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion). Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

Unit – IV:

DIFFERENTIATION AND MEAN VALUE THEORMS:

The derivability of a function at a point and on an interval - Derivability and continuity of a function -Mean value Theorems -Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

Unit – V:

RIEMANN INTEGRATION:

Riemann Integral - Riemann integral functions - Darboux theorem -Necessary and Sufficient condition for R integrability - Properties of integrable functions - Fundamental theorem of integral calculus - integral as the limit of a sum - Mean value Theorems.

Activities:

Seminar/ Quiz/ Assignments/ Applications of Real Analysis to Real life Problem /Problem Solving Sessions.

Text Book: A Text Book of B.Sc Mathematics Real Analysis (IV Semester) by Authors : V. VENKATESWARA RAO, Dr. R. BHARAVI SHARMA, B.V.S.S. SARMA, N. KRISHNAMURTHY, S. ANJANEYA SASTRY & S. Ranganatham – S Chand Publications

Reference Books:

1. Elements of Real Analysis by Shanthi Narayan and Dr. M. D. Raisinghania, S. Chand & Company Pvt. Ltd., New Delhi.
2. Principles of Mathematical Analysis by Walter Rudin, McGraw-Hill Ltd.
3. An Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, John Wiley and sons Pvt. Ltd

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **MATHEMATICS** TIME: 3Hrs/Week

M-Ma3-4301(3) **INTEGRAL TRANSFORMS WITH APPLICATIONS** Max.Marks:100

w.e.f AK 2023-2024 (Admitted Batch) **SYLLABUS**

Course Objectives: To enable the students to

CO1: Apply the Laplace transform technique to solve ordinary differential equations (ODEs), Understand the solutions of ODEs with constant coefficients and variable coefficients. **(K2 & K3)**

CO2: Analyse the solutions of simultaneous ordinary differential equations, Understand the application of Laplace transforms to partial differential equations. **(K2 & K4)**

CO3: Apply Laplace transforms to integral equations, Understand the concept of Abel's integral equation and convolution-type integral equations. **(K2 & K3)**

CO4: Analyse the properties of the Fourier transform, Understand the linear property, change of scale property, and modulation theorem. **(K2 & K4)**

CO5: Apply the concept of convolution in Fourier transforms, Understand Parseval's identity and finite Fourier transforms. **(K2 & K3)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Solve ODEs using Laplace transforms, Analyse the behaviour of solutions based on coefficient variations. **(K3 & K4)**

CO2: Solve systems of simultaneous ODEs using Laplace transforms, Apply Laplace transforms to partial differential equations. **(K3)**

CO3: Solve integral equations using Laplace transforms, Explore applications of Laplace transforms in integral equations. **(K3)**

CO4: Compute Fourier transforms and apply the modulation theorem, Explore the relationship between Fourier and Laplace transforms. **(K4)**

CO5: Compute convolutions using Fourier transforms, apply finite Fourier transforms and understand inversion formulas. **(K3)**

Course Content

Unit – I:Application of Laplace Transform to solutions of Differential Equations:

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

Unit – II: Application of Laplace Transform to solutions of Differential Equations:

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

Unit – III: Application of Laplace Transforms to Integral Equations:

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type - Integral Differential Equations - Application of L.T. to Integral Equations.

Unit – IV: Fourier Transforms – I:

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

Unit – V: Fourier Transforms – II:

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations -Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform - Inversion formula for sine and cosine transforms only - statement and related problems.

Activities: Seminar/ Quiz/ Assignments/Applications of Integral Transforms in real life problems /Problem Solving Sessions.

Text Book:

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.

Reference Book:

1. Fourier Series and Integral Transformations by Dr. S. Sreenadh and others, published by S. Chand and Co, New Delhi
2. E. M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press, 2003).
3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003).

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER MATHEMATICS TIME: 2Hrs/Week

M-Ma3-4351(2) INTEGRAL TRANSFORMS WITH APPLICATIONS Max.Marks:50

w.e.f AK 2023-2024 (Admitted Batch) PRACTICAL SYLLABUS

Course Objectives: To enable the students to

CO1: Apply the Laplace transform technique to solve ordinary differential equations (ODEs), Understand the solutions of ODEs with constant coefficients and variable coefficients. **(K2 & K3)**

CO2: Analyse the solutions of simultaneous ordinary differential equations, Understand the application of Laplace transforms to partial differential equations. **(K2 & K4)**

CO3: Apply Laplace transforms to integral equations, Understand the concept of Abel's integral equation and convolution-type integral equations. **(K2 & K3)**

CO4: Analyse the properties of the Fourier transform, Understand the linear property, change of scale property, and modulation theorem. **(K2 & K4)**

CO5: Apply the concept of convolution in Fourier transforms, Understand Parseval's identity and finite Fourier transforms. **(K2 & K3)**

Course Outcomes:

After successful completion of this course, the student will be able to

CO1: Apply theoretical / analytical /statistical knowledge gained in various courses of B.Sc to solve numerica lproblems based on real life situations during practical and draw meaningful solutions to day-to-day problems. **(K3)**

CO1: Solve ODEs using Laplace transforms, Analyse the behaviour of solutions based on coefficient variations. **(K3 & K4)**

CO2: Solve systems of simultaneous ODEs using Laplace transforms, Apply Laplace transforms to partial differential equations. **(K3)**

CO3: Solve integral equations using Laplace transforms, Explore applications of Laplace transforms in integral equations. **(K3)**

CO4: Compute Fourier transforms and apply the modulation theorem, Explore the relationship between Fourier and Laplace transforms. **(K4)**

CO5: Compute convolutions using Fourier transforms, apply finite Fourier transforms and understand inversion formulas. **(K3)**

Course Content

Unit – I:Application of Laplace Transform to solutions of Differential Equations:

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

Unit – II: Application of Laplace Transform to solutions of Differential Equations:

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

Unit – III: Application of Laplace Transforms to Integral Equations:

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type - Integral Differential Equations - Application of L.T. to Integral Equations.

Unit – IV: Fourier Transforms – I:

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

Unit – V: Fourier Transforms – II:

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations -Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform - Inversion formula for sine and cosine transforms only - statement and related problems.

Activities: Seminar/ Quiz/ Assignments/Applications of Integral Transforms in real life problems /Problem Solving Sessions.

Text Book:

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.

Reference Book:

1. Fourier Series and Integral Transformations by Dr. S. Sreenadh and others, published by S. Chand and Co, New Delhi
2. E. M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press, 2003).
3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003).

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SEMESTER-V

COURSE 14 A: SPECIAL FUNCTIONS

Theory | Credits: 4 | 5 hrs/week

LearningOutcomes

Aftersuccessfulcompletionofthecoursewillbeableto

1. UnderstandtheBetaandGammafunctions,theirpropertiesandrelationbetweenthesetwo functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
2. findpowerseriessolutionsofordinarydifferential equations.
3. solveHermiteequationandwritetheHermitePolynomialoforder(degree)n,also findthe generating function for Hermite Polynomials, study the orthogonal properties of Hermite
   Polynomials and recurrence relations.
4. Solve Legendre equation and write the Legendre equation of first kind, also find the generatingfunctionforLegendrePolynomials,understandtheorthogonalpropertiesof Legendre Polynomials.
5. SolveBesselequationandwritetheBesselequationoffirstkindofordern,alsofindthe generating function for Bessel function understand the orthogonal properties of Bessel unction.

Course Content

Unit–1

BetaandGammafunctions,Chebyshevpolynomials

Euler'sIntegrals-BetaandGammaFunctions,ElementarypropertiesofGammaFunctions, TransformationofGamma Functions.

AnotherformofBetaFunction,Relationbetween BetaandGamma Functions.

Chebyshevpolynomials,orthogonalpropertiesofChebyshevpolynomials,recurrence relations, generating functions for Chebyshev polynomials.

Unit–2

PowerseriesandPowerseriessolutionsofordinarydifferentialequations

Introduction,summaryofusefulresults,powerseries,radiusofconvergence,theorems on Power series Introductionofpowerseriessolutionsofordinarydifferential equation Ordinaryandsingularpoints,regularandirregularsingularpoints,power series solution.

Unit–3

Hermitepolynomials

HermiteDifferentialEquations,SolutionofHermiteEquation,Hermite polynomials, generating function for Hermite polynomials.OtherformsforHermitePolynomials,RodriguesformulaforHermite Polynomials, to find first few Hermite Polynomials.OrthogonalpropertiesofHermitePolynomials,Recurrenceformulaefor Hermite Polynomials.

Unit–4

Legendrepolynomials

Definition,SolutionofLegendre'sequation,Legendrepolynomialofdegree n, generating function of Legendre polynomials.Definitionof$P_n(x)$and$Q_n(x)$, GeneralsolutionofLegendre'sEquation(derivationsnot required)toshowthat$P_n(x)$isthecoefficientof h^n,intheexpansionof $(1-2xh+h^2)^{-}$

1/2Orthogonalpropertiesof Legendre'spolynomials,Recurrenceformulasfor Legendre's Polynomials.

Unit–5

Bessel'sequation

Definition,Solutionof Bessel'sequation,Bessel'sfunctionofthefirstkindof ordern,Bessel's functionofthesecondkindofordern.

IntegrationofBessel'sequationinseriesform=0, Definition of $J_n(x)$ recurrenceformulaefor $J_n(x)$ Generating function for $J_n(x)$,orthogonally of Bessel functions.

Activities

Seminar/ Quiz/ Assignments/ Applications of Special functions to Real life Problem /Problem Solving Sessions.

Text Book

SpecialFunctions by J.N.SharmaandDr.R.K.Gupta,KrishnaPrakashan,

ReferenceBooks

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand &CompanyPvt. Ltd., Ram Nagar, New Delhi-110055.
3. GeorgeF.Simmons,DifferentialEquationswithApplicationsandHistoricalNotes,Tata McGRAW-Hill Edition, 1994.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER
M-E1-5303(3)
w.e.f .20AH Batch

MATHEMATICS
NUMERICAL METHODS
SYLLABUS

TIME: 3Hrs/Week
Max.Marks:100

Course Objectives:

To enable the students to

- Define Basic concepts of operators Δ, E, ∇
- Define The Calculus of Finite Differences
- Find the difference of polynomial and define Interpolation with Equal Intervals.
- Prove theorems and Solve problems using Newton forward formula and Newton backward formula.
- Find the difference of polynomial and define Interpolation with unequal Intervals
- Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula.
- Discuss about Numerical Differentiation and Integration.
- Find maxima and minima for differential equation.
- DeriveTrapezoidalrule,Simpson's1/3,3/8rules by using General Quadrature formula
- Derive Numerical Solution of Ordinary Differential Equations by using Taylor's Series, Picard method of successive approximations, Euler's Method, Modified Euler's Method and Rung - Kutta Method

Course Outcomes:

Students after successful completion of the course will be able to:

1. Understand the subject of various numerical methods that are used to obtain approximate solutions.
2. Understand various finite difference concepts and interpolation methods.
3. Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
4. Find numerical solutions of ordinary differential equations by using various numerical methods.
5. Analyze and evaluate the accuracy of numerical methods.

Course Syllabus:

UNIT–1: Finite Differences and Interpolation with Equal intervals

(A) THE CALCULUS OF FINITE DIFFERENCES:

1. Finite Differences – Introduction, Forward and Backward Differences,
2. Differences Formulae, Fundamental theorem of the differential calculus.
3. The Operators Δ, ∇ *and* E,
4. One or More missing terms,
5. Factorial Notation, Methods of representing any given polynomial in factorial notation.

(B) INTERPOLATION WITH EQUAL INTERVALS:

1. Newton-Gregory forward formula for Interpolation,
2. Newton-Gregory formula for backward Interpolation.

P.T.O

as Partly orderedsets, Diagrams of lattices, Sub lattices, Ideals (Chapter 2, section 10-16 of the Text Book)

Unit –III

Lattices in General (Continued)

Bound Elements of a lattice, Atoms and Dual Atoms, Complements, Relative Complements, Semicomplements, Irreducible Prime Elements of a lattice, The Homomorphism of a lattice, AxiomSystems of lattices (Chapter 2, section 17-21 of the Text Book)

UNIT – IV

Complete lattices

Complete lattices, Complete Sub lattices of a Complete lattice, Conditionally Complete Lattices, Compact Elements, Compactly Generated lattices, Subalgebra lattice of an Algebra, Closure Operations (Chapter 3, Sections 22-27 of the Text Book)

UNIT – V

Distributive and Modular Lattices

Distributive lattices, Infinitely Distributive and Completely Distributive lattices, Modular lattices,Characterization of Modular and Distributive lattices by their Sublattices, Distributive Sublattices ofModular Lattices.(Chapter 3, Sections 30-34 of the Text Book)

Activities:

1. Assignments
2. Student Seminars and Guest Lecturers
3. Problem Solving Sessions

Text Book:

Introduction to Lattice Theory, Gabor Szasz, Academic press

Reference Book:

1. "Lattice Theory", G. Birkhoff, Amer. Math. Soc.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER | MATHEMATICS | TIME: 2Hrs/Week

M-E1-5353(2) | NUMERICAL METHODS | Max.Marks:50

w.e.f. 20AH Batch | MATHS PRACTICAL – IIIA

Course Objectives:

To enable the students to

Define Basic concepts of operators Δ , E, ∇

Define The Calculus of Finite Differences

Find the difference of polynomial and define Interpolationwith Equal Intervals

Prove theorems and Solve problems using Newton forward formula and Newtonbackward formula.

Find the difference of polynomial and define Interpolationwith unequal Intervals

Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula

Discuss about Numerical Differentiation and Integration

Find maxima and minima for differential equation

Derive Trapezoidal rule, Simpson's 1/3 ,3/8 rules by using General Quadrature formula

Derive Numerical Solution of Ordinary Differential Equations by using Taylor's Series, Picard method of successive approximations, Euler's Method, Modified Euler's Method and Rung - Kutta Method

Course Outcomes:

Students after successful completion of the course will be able to:

- **CO1:** apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practicals and draw meaningful solutions to day to day problems
- **CO2:** enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study
- **CO3:** enhancing students overall development and to equip them with mathematical abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- **CO4:** problem solving on Calculus of finite differences, Interpolation with equal and unequal intervals, central interpolation formulae, Numerical differentiation and integration, Transcendental and algebraic equations
- **CO5:** acquire basic knowledge in solving interpolation with equal interval problems by various numerical methods. Estimate the missing terms through interpolation methods.
- **CO6:** develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method.
- **CO7:** use relevant numerical techniques for interpolation with equal and unequal intervals by using various central difference formulae and code a numerical method in a modern computer language.
- **CO8:** Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
- **CO9:** Find numerical solutions of ordinary differential equations by using various numerical methods.
- **CO10:** Analyze and evaluate the accuracy of numerical methods.

P.T.O.

M-E1-5353(2)

Course Syllabus

Unit–1: Finite Differences and Interpolation with Equal Intervals:

(A) THE CALCULUS OF FINITE DIFFERENCES:

1. Finite Differences – Introduction, Forward and Backward Differences,
2. Differences Formulae, Fundamental theorem of the differential calculus.
3. The Operators Δ, ∇ and E, ,
4. One or More missing terms
5. Factorial Notation, Methods of representing any given polynomial in factorial notation.

(B) INTERPOLATION WITH EQUAL INTERVALS:

1. Newton-Gregory forward formula for Interpolation,
2. Newton-Gregory formula for backward Interpolation.

Unit–2: Interpolation with Equal and Unequal intervals:

(A) INTERPOLATION WITH UNEQUAL INTERVALS:

1. Introduction, Divided differences, Properties of divided differences,
2. Relation between divided differences and ordinary differences,
3. Newton's divided difference formula,
4. Lagrange's interpolation formula for unequal intervals.

(B) CENTRAL DIFFERENCE INTERPOLATION FORMULAE:

1. Introduction, Gauss's Forward interpolation formula, Gauss's Backward formula
2. Stirling's formula, Bessel's formula, Laplace-Everett formula,
3. The Central Difference Operator (δ), the Average Difference Operator (μ)

Unit–3: Numerical Differentiation

1. Derivatives using Newton's forward and backward difference formula,
2. Derivatives using central difference formula, Stirling's interpolation formula,
3. Newton's divided difference formula, Maximum and minimum values of a tabulated function.

Unit–4: Numerical Integration

1. General quadrature formula one errors, Trapezoidal rule,
2. Simpson's1/3–rule, Simpson's3/8–rule, and Weddle's rule,
3. Euler–McLaurin Formula of summation and quadrature, The Euler transformation.

Unit–5: Numerical Solution of Ordinary Differential Equations:

1. Introduction, Solution by Taylor's Series
2. Picard's method of successive approximations
3. Euler's method, Modified Euler's method
4. Runge–Kutta methods

Prescribed Textbook:

1. S. Ranganatham, Dr.M.V.S.S.N. Prasad, Dr.V.Ramesh Babu, Numerical Analysis, S.Chand & Company Pvt.Ltd., RamNagar, NewDelhi-110055.(2021)

References:

1. S.S.Sastry,Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi-110001, 2006.
2. P.Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis. S.Chand&Company,Pvt.Ltd., Ram Nagar, New Delhi-110055.
3. R.Gupta,Numerical Analysis, Laxmi Publications(P) Ltd., New Delhi.
4. H.C. Saxena, Finite Differences and Numerical Analysis, S.Chand& Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
5. Calculus of finite differences and Numerical analysis by Prof. P.P.Gupta and G.S.Malik-Krishna Prakashan Media (P) Ltd. Meerut (U.P).
6. Web resources suggested by the teacher and college librarian including reading material.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER | MATHEMATICS | TIME: 3Hrs/Week

M-E1-5304(3) | MATHEMATICAL SPECIAL FUNCTIONS | Max.Marks:100

w.e.f. 20AH Batch | SYLLABUS

Course Objectives:

To enable the students to

- Derive Euler's Integrals –Beta and Gamma Functions, Elementary Properties of Gamma Functions, Transformation of Gamma functions
- Derive Another form of Beta functions, Relation between Beta and Gamma functions, Other transformations, Legendre Duplication Formula
- Define Legendre's equation, Pn(x) and Qn(x) , show that Pn(x) is the coefficient of h^n in the expansion in ascending powers of $(1-2xh+h^2)^{-1/2}$
- Derive Laplace definite integral for Pn(x), Orthogonal properties of Legendre's Polynomials ,Recurrence formulae, Beltrami's results, Christoffer's summation Formula, Rodrigue's Formula
- Derive Hermite Differential Equation, Hermite Polynomials, Generating Function, Other forms for the Hermite Polynomials
- Find first few Hermite Polynomials, Orthogonal Properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials
- Derive Bessel's equation, General Solution of Bessel's equation and Define of $J_o(X)$, Recurrence Formulae for $J_n(X)$.
- Define power series solutions of ordinary differential equations.

Course Outcomes:

Students after successful completion of the course will be able to:

1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
2. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
3. Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.
4. Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function.
5. Find power series solutions of ordinary differential equations.

P.T.O.

Course Syllabus

UNIT–1: Beta and Gamma Functions, Chebyshev Polynomials:

1. Euler's Integrals - Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.
3. Chebyshev polynomials, Orthogonal properties of Chebyshev polynomials, Recurrence relations, Generating functions for Chebyshev polynomials.

(Chapter 2.9 – 2.15 and 8.1 – 8.8)

UNIT–2: Legendre Polynomials:

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree 'n', Generating function of Legendre polynomials.
2. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n, in the expansion of $(1-2xh+h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials, Rodrigue's formula for Legendre's Polynomials.

(Chapter 2.1 – 2.5 and 2.7, 2.8 & 2.12)

UNIT–3: Hermite Polynomials:

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, Generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

(Chapter 6.1 – 6.8)

UNIT–4: Bessel's Equation:

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order 'n', Bessel's function of the second kind of order 'n'.
2. Integration of Bessel's equation in series for m=0, Definition of $J_n(x)$, Recurrence formulae for $J_n(x)$.
3. Generating function for $J_n(x)$, Orthogonally of Bessel's functions.

(Chapter 5.1 – 5.7)

UNIT–5: Power Series and Power Series Solutions of Ordinary Differential Equations:

1. Introduction, summary of useful results, power series, some important facts about the power series, radius of convergence
2. Introduction of power series solutions of ordinary differential equation
3. Ordinary and singular points, regular and irregular singular points, power series solution.

(Chapter 7.1 – 7.7 and 8.1 to 8.4)

P.T.O.

Prescribed textbook:

1. J.N.Sharma and Dr.R.K.Gupta, Special functions, Krishna Prakashan Media(P) Ltd. **(Unit-1 to Unit - 4)**
2. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S.Chand &Company Pvt. Ltd., Ram Nagar, New Delhi-110055. **(Unit – 5)**

Reference Books:

1. Shanti Narayan and Dr.P.K.Mittal ,Integral Calculus, S.Chand& Company Pvt.Ltd.,Ram Nagar, New Delhi-110055.
2. George F.Simmons, Differential equations with Applications and Historical Notes, Tata McGRAW-Hill Edition,1994.
3. Shepley L.Ross, Differential equations, Second Edition, JohnWilly &Sons, NewYork, 1974.
4. Web resources suggested by the teacher and college librarian including reading material.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER | **MATHEMATICS** | TIME: 2Hrs/Week

M-E1-5354(2) | **MATHEMATICAL SPECIAL FUNCTIONS** | Max.Marks:50

w.e.f. 20AH Batch | **MATHEMATICS PRACTICAL – IIIB**

SYLLABUS

Course Objectives:

To enable the students to

- Derive Euler's Integrals – Beta and Gamma Functions, Elementary Properties of Gamma Functions, Transformation of Gamma functions.
- Derive another form of Beta functions, Relation between Beta and Gamma functions, other transformations, Legendre Duplication Formula.
- Define Legendre's equation, Pn(x) and Qn(x) , show that Pn(x) is the coefficient of h^n in the expansion in ascending powers of $(1-2xh+h^2)^{-1\backslash 2}$
- Derive Laplace definite integral for Pn(x), Orthogonal properties of Legendre's Polynomials ,Recurrence formulae, Beltrami's results, Christoffer's summation Formula, Rodrigue's Formula
- Derive Hermite Differential Equation , Hermite Polynomials, Generating Function, Other forms for the Hermite Polynomials
- Find first few Hermite Polynomials, Orthogonal Properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials
- Derive Bessel's equation, General Solution of Bessel's equation and Define of $J_o(X)$, Recurrence Formulae for $J_n(X)$.
- Define power series solutions of ordinary differential equations.

Course Outcomes:

Students after successful completion of the course will be able to

1. Apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practicals and draw meaningful solutions to day to day problems.
2. Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study
3. Enhancing students overall development and to equip them with mathematical abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
4. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
5. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
6. Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.
7. Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function.
8. Find power series solutions of ordinary differential equations.

Course Syllabus:

Unit–1: Beta and Gamma Functions, Chebyshev Polynomials:

1. Euler's Integrals - Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.
3. Chebyshev polynomials, Orthogonal properties of Chebyshev polynomials, Recurrence relations, Generating functions for Chebyshev polynomials.

(Chapter 2.9 – 2.15 and 8.1 – 8.8)

Unit–2: Legendre Polynomials:

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree 'n', Generating function of Legendre polynomials.
2. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n, in the expansion of $(1-2xh+h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials, Rodrigue's formula for Legendre's Polynomials.

(Chapter 2.1 – 2.5 and 2.7, 2.8 & 2.12)

Unit–3: Hermite Polynomials

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, Generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

(Chapter 6.1 – 6.8)

Unit–4: Bessel's Equation

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order 'n', Bessel's function of the second kind of order 'n'.
2. Integration of Bessel's equation in series for m=0, Definition of $J_n(x)$, Recurrence formulae for $J_n(x)$.
3. Generating function for $J_n(x)$, Orthogonally of Bessel's functions.

(Chapter 5.1 – 5.7)

Unit–5: Power Series and Power Series Solutions of Ordinary Differential Equations

1. Introduction, summary of useful results, power series, some important facts about the power series, radius of convergence.
2. Introduction of power series solutions of ordinary differential equation.
3. Ordinary and singular points, regular and irregular singular points, power series solution.

(Chapter 7.1 – 7.7 and 8.1 to 8.4)

P.T.O.

Prescribed textbook

1. J.N.Sharma and Dr.R.K.Gupta, Special functions, Krishna Prakashan Media(P) Ltd. **(Unit-1 to Unit - 4)**
2. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055. **(Unit – 5)**

Reference Books:

1. Shanti Narayan and Dr.P.K.Mittal ,Integral Calculus, S.Chand & Company Pvt.Ltd.,RamNagar, New Delhi-110055.
2. George F.Simmons, Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.
3. Shepley L.Ross, Differential equations, Second Edition, John Willy& Sons, New York, 1974.
4. Web resources suggested by the teacher and college librarian including reading material.

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