A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA

DEPARTMENT OF MATHEMATICS

SYLLABUS

2025-26

SEM	Course Title	Course Code	Credits	Hrs/Wk
I	DIFFERENTIAL EQUATIONS	MAT25101	4	5

Course Objectives :

1. To introduce the concepts and methods for solving first-order differential equations, including exact, linear, and Bernoulli equations.
2. To understand special types of first-order differential equations such as Clairaut's equations and those solvable for p, x or y.
3. To develop techniques for solving higher-order linear differential equations with constant coefficients.
4. To apply the operator method for finding particular integrals of non-homogeneous differential equations with various types of right-hand side functions.
5. To learn the method of variation of parameters for solving non-homogeneous differential equations.

Course Outcomes:

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

1. Solve exact differential equations, linear equations, Bernoulli's equations, and equations reducible to exact form using integrating factors.
2. Analyze and solve first-order differential equations that are solvable for p, , and y, including Clairaut's equations.
3. Solve homogeneous and non-homogeneous linear differential equations of higher order with constant coefficients using operator methods.
4. Compute particular integrals for non-homogeneous equations when the right-hand side is a polynomial, exponential, or trigonometric function.
5. Solve non-homogeneous differential equations using the method of variation of parameters and other applicable techniques.

Unit – 1

Exact Differential Equations - Integrating factors - Equations reducible to Exact Equations by Integrating Factors (i) 1 /Mx+ Ny (ii) 1 /Mx -Ny – - Linear Differential Equations – Bernoulli's Equations

Unit – 2

Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation

Unit – 3

Solutions of homogeneous linear differential equations of second and higher order with constant coefficients f(D)y = 0 - Solutions of non-homogeneous linear differential equations f(D)y = Q(x) of second order with constant coefficients by means of polynomial operators (i) $Q(x) = b\ e\ ax$ where b is a real constant - (ii) $Q(x) = Sin\ ax$ (or) $Cos\ ax$ where a is a real constant.

Unit – 4

Solution to a non-homogeneous linear differential equations of second order with constant coefficients by means of polynomial operators $(x) = b\ x$, $Q(x) = e\ ax\ V$, where V is a function of x.

Unit – 5

Solution of the non-homogeneous linear differential equations of second order with constant coefficients by means of polynomial operators $Q(x) = x\ V$, where V is a function of x – Problems on Method of Variation of parameters to find solutions of linear differential equations with variable coefficients.

Activities

The activities planned throughout the Differential Equations course include a variety of interactive and evaluative methods such as quizzes, assignments, seminars, and student presentations. Students will also engage in a mini project, prepare concept flowcharts, and participate in operator method chart activities. Peer teaching sessions, LMS-based online quizzes, and board work challenges will foster collaborative and digital learning. Additionally, poster presentations on applications and visual aids like chalk talks will be incorporated to support diverse learning styles and deepen conceptual clarity.

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

SEM	Course Title	Course Code	Credits	Hrs/Wk
I	Solid Geometry	**MAT25102**	**4**	**5**

Course Objectives

1. To introduce fundamental concepts of planes, lines, and spheres in 3D geometry.
2. To develop analytical skills for deriving equations of planes, lines, and spheres in different forms.
3. To analyze geometric relationships, including angles, distances, and intersections between lines, planes, and spheres.
4. To study advanced properties of spheres, such as tangents, polar planes, and orthogonality conditions.
5. To apply geometric principles to solve problems involving coplanarity, shortest distances, and sphere-line/plane interactions.

Course Outcomes

After completing this course, students will be able to

1. Derive and interpret equations of planes and lines in various forms.
2. Compute angles, distances, and intersection conditions between geometric elements (lines, planes, spheres).
3. Determine coplanarity of lines and solve problems involving shortest distances in 3D space.
4. Analyse sphere-related problems, including tangents, intersections, and circle equations in 3D.
5. Apply advanced concepts like polar planes, conjugate points, and orthogonality conditions of spheres. Course Content

Unit – 1

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

Unit – 2

Equation of a line in various forms - 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

Unit – 3

The shortest distance between two skew lines - The length and equations of the line of shortest distance between two skew lines - Length of the perpendicular from a given point to a given line.

Unit – 4

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

Unit – 5

Power of a point - Tangent plane - Plane of contact; Polar plane - Pole of a Plane - Conjugate points - Conjugate planes - Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical Plane – Coaxial system of spheres-Limiting Points.

Activities

The activities include quizzes, assignments, seminars, and student presentations. Additional tasks involve mini projects, concept flowcharts, operator method charts, peer teaching, LMS-based quizzes, board work challenges, poster presentations, and visual aids like chalk talks to enhance learning and engagement.

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 Tata McGraw - Hill Publishers. 3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

SEM	Course Title	Course Code	Credits	Hrs/Wk
II	Group theory	MAT25201	4	5

Course Objectives

1. To introduce students to the foundational concepts of algebraic structures with a focus on groups.
2. To develop an understanding of subgroups, cosets, and their relevance in group theory.
3. To explore the properties and significance of normal subgroups and their role in constructing quotient groups.
4. To study and apply the concepts of group homomorphisms, isomorphisms, and the fundamental theorem of homomorphism.
5. To examine the structure and properties of permutation and cyclic groups, including their role in group classification.

Course Outcomes

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

1. Understand the definition and basic properties of groups, including finite and infinite groups, and construct composition tables.
2. Analyze subgroups and cosets, apply Lagrange's Theorem, and understand the structure of a group through its subgroups.
3. Identify and verify normal subgroups, and understand their role in forming quotient groups.
4. Understand and apply homomorphisms and isomorphisms, including the fundamental homomorphism theorem and its applications.
5. Work with permutations, transpositions, and cyclic groups, and understand their properties and significance in group theory, including Cayley's Theorem. Course Content

ABSTRACT ALGEBRA

Unit – 1 GROUPS

Binary Operation – Algebraic structure – Semi group - Monoid – Group definition and its elementary properties - Finite and Infinite groups – examples – order of a group - Composition tables with examples.

Unit – 2 SUBGROUPS

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

Unit – 3 NORMAL SUBGROUPS

Normal Subgroups - Definition of normal subgroup – Proper and improper normal subgroups – 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 HOMOMORPHISM

Quotient groups - Definition of homomorphism – Image of a homomorphism- Elementary properties of homomorphisms – Isomorphism – Automorphism- Definitions and elementary properties–Kernel of a homomorphism – Fundamental theorem of Homomorphism and applications.

Unit – 5 PERMUTATIONS AND CYCLIC GROUPS

Definition of permutation –Multiplication of Permutations– Inverse of a permutation – Cyclic permutations – Transposition – Even and odd permutations – Cayley's theorem - Cyclic Groups - Definition of cyclic group – Elementary properties

Activities

The activities include quizzes, assignments, seminars, and student presentations. Additional tasks involve mini projects, concept flowcharts, operator method charts, peer teaching, LMS-based quizzes, board work challenges, poster presentations, and visual aids like chalk talks to enhance learning and engagement.

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 Pragathi Prakashan

Reference Books :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan
4. Ccelms.ap.gov.in

5. SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc Major (II Sem)	ELEMENTRAY REAL ANALYSIS	**MAT25202**	**4**	**5**

Course Objectives

1. To develop a strong foundation in the real number system and its axiomatic structure.
2. To introduce the concepts of order, bounds, completeness, and related foundational properties of real numbers.
3. To explore the properties of sets in real analysis, including neighborhoods, limit points, open and closed sets. 4. To build analytical skills in handling sequences, convergence criteria, and monotonicity.
5. To understand the behavior of infinite series and apply standard convergence tests effectively.

Course Outcomes

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

1. Understand the real number system, its axioms, and properties, including completeness, supremum, and infimum.
2. Apply the Archimedean property, denseness, and concepts of neighborhoods, limit points, and derived sets in problem-solving.
3. Analyze sequences for boundedness and convergence using definitions and the Cauchy criterion.
4. Understand the concept of subsequences, apply the Bolzano-Weierstrass theorem, and test convergence using Cauchy's general principle.
5. Determine the convergence of infinite series using various tests and solve related analytical problems. Course Content

Unit – 1

Real number system - Field axioms – Properties of real numbers - Order axioms – Properties of Order relation - Principal of induction - Extended real number system – Modulus of a real number – Properties of modulus – Triangle property - Aggregates – Finite and infinite aggregates – Boundedness of an aggregate – Least upper bound (supremum) and greatest lower bound (infimum) of an aggregate – Properties of boundedness – Completeness axiom – Dedekind's theorem - Theorem on Dedekind's axiom and completeness axiom.

Unit – 2

Archemedian Property - It's corollaries – Integral part of a real number - Denseness of the real number system – Intervals – Neighbourhood of a point - Limit point of an aggregate – Derived Set - Bolzano - Weierstrass theorem – Interior point of a set - Open and closed Sets – It's properties (without proofs) - Countable and uncountable sets - Properties of countable sets.

Unit – 3

Sequences – Operations of sequences - Subsequences - Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence – Divergent sequence – Uniqueness of a limit – Sandwich theorem on sequences - Monotone sequences - Problems

Unit – 4

Limit Point of a Sequence - Bolzano-Weierstrass theorem on subsequences – Cauchy Sequences – Cauchy's general principle of convergence - Problems

Unit – 5

Infinite Series – Convergence and divergence of series - Cauchy's general principle of convergence for series – Series of non-negative terms - Convergence of geometric series – p series test - comparison test –D'Alemberts's ratio test – Cauchys's nth root test – problems.

Activities

The activities include quizzes, assignments, seminars, and student presentations. Additional tasks involve mini projects, concept flowcharts, operator method charts, peer teaching, LMS-based quizzes, board work challenges, poster presentations, and visual aids like chalk talks to enhance learning and engagement.

Text Book : An Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, John Wiley and sons Pvt. Ltd

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.

SEM	Course Title	Course Code	Credits	Hrs/Wk
III	Group Theory	**M-MAT24301**	**5**	**6**

Course Outcomes:

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

CO 1. Acquire the basic knowledge and structure of groups.

CO 2. Get the significance of the notation ofa subgroup and cosets.

CO 3. Understand the concept of normalsubgroups and properties of normal subgroup.

CO 4. Study the homomorphisms and isomorphisms with applications.

CO 5. Understand the properties ofpermutation and cyclic groups.

ABSTRACT ALGEBRA

UNIT I : 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 II: SUBGROUPS:

Complex Definition – Multiplication of two complexes Inverse of a complex- Subgrup 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 Theore

UNIT III: 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 IV HOMOMORPHISM:

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 V: 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 cyclicgroups.

Additional Input: Ideals of a rings, Properties, Principal Ideal, homomorphism, first homomorphism theorem, maximal and prime ideal.

** The External Examination paper setters shouldn't set the questions from additional inputs.

Co-Curricular Activities (15 Hours)

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

Text Book :

A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand & Company, New Delhi.

Reference Books :

6. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
7. Modern Algebra by M.L. Khanna.
8. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan
9. Ccelms.ap.gov.in/

SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc Major (III Sem)	**Numerical Methods**	**MAT24302**	**4**	**5**

CO 1. Difference between the operators,Δ,∇,E and the relation between them.
CO 2. Know about the Newton – Gregory Forward and backward interpolation.
CO3. Know the Central Difference operators, δ, μ, σ and relation between them.
CO 4. Solve Algebraic and Transcendental equations.
CO 5.Understand the concept of Curvefitting

Unit – 1:

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 – 2: 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 - Stirlings 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,Ramanujan's method (No question is to be set from this portion)

Unit – 5: Curve Fitting

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

Additional inputs :

Ramanujan's method

Text Book

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

References:

Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7th Edition

1.Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
2. 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.

Co-Curricular Activities:

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

SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc. Major (III Sem)	**Laplace Transforms**	**MAT24303**	**4**	**5**

CO 1. Understand the definition and properties of Laplace transformations
CO 2. Get an idea about first and second shifting theorems and change of scale property.
CO 3. Understand Laplace transforms of standard functions like Bessel, Error function etc.
CO 4. Know the reverse transformation of Laplace and properties.
CO 5. Get the knowledge of application of convolution theorem

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

Co-Curricular Activities

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

TEXT BOOK:

LaplaceTransforms by A.R.Vasishtha,Dr.R.K.Gupta,KrishnaPrakashanMedia Pvt.Ltd., Meerut.

REFERENCE BOOKS:

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press

2. Laplace and Fouries transforms by Dr.J.K. Goyal and K.P. Guptha, PragathiPrakashan, Meerut.

SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc. Major (III Sem)	SPECIAL FUNCTIONS	MAT24304	4	5

Course OutComes :

CO 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.

CO 2. Find power series solutions of ordinary differential equations.

CO 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.

CO 4. 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.

CO 5. 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 unction.

UNIT I

Beta and Gamma functions, Chebyshev polynomials

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.

Another form of Beta Function, Relation between Beta and Gamma Functions.
Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

UNIT II:

Power series and Power series solutions of ordinary differential equations.

Introduction, summary of useful results, power series, radius of convergence, theorems on Power series

Introduction of power series solutions of ordinary differential equation Ordinary and singularpoints, regular and irregular singular points, power series solution

UNIT III:

Hermite polynomials

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

.

UNIT IV:

Legendre polynomials

Definition, Solution of Legendre's equation, Legendre polynomial of degree n, generatingfunction of Legendre polynomials. ,

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 $(1 - 2xh + h^2)^{-1/2}$

Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre'sPolynomials.

UNIT V:

Bessel's equation

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.

Integration of Bessel's equation in series form=0, Definitionof $J_n(x)$,recurrence formulae for$J_n(x)$. 3. Generating function for $J_n(x)$, orthogonally of Bessel functions.

Co-Curricular Activities

Seminar/ Quiz/ Assignments/ Applications of Functions of complex variables to Real life Problem /Problem Solving Sessions.

TEXT BOOK:

Theory of Functions of a Complex variable by Shanti Narayan &Dr. P. K. Mittal, S. Chand &Company Ltd.

REFERENCE BOOKS:

1. Theory of Functions of a Complex Variable by A. I. Markushevich, Second Edition, AMS Chelsea Publishing

2. Theory And Applications by M. S. Kasara, Complex Variables, 2nd Edition, Prentice Hall India Learning Private Limi

SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc. Major & Minor(IV Sem)	**Ring Theory**	**MAT23401** **M- MAT23401**	**5**	**6**

CO 1. Acquire the basic knowledge of rings, fields and integral domains.
CO 2. Get the knowledge of subrings andideals.
CO 3. Construct composition tables forfinite quotient rings.
CO 4. Study the homomorphisms and isomorphisms with applications.
CO 5. Get the idea of division algorithm ofpolynomials over a field.

Unit – 1 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.

Unit-2 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

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.

Unit – 4 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 – 5 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 $F[x]$.

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /ProblemSolving 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

SEM	Course Title	Course Code	Credi ts	Hrs/Wk
II B.Sc. Major&Minor(IVSem)	Introduction to Real Analysis	MAT23402 M- MAT23402	**5**	**6**

CO1.Get clear idea about the real numbers and real valued functions.
CO2. Obtain the skills of analysing the concepts and applying appropriate methods Of test ingconvergence of a sequence/ series.
CO3. Test the continuity and differentiability and Riemann integration ofa function.
CO4. Know the geometrical interpretation of mean value theorems.
CO 5. Know about the fundamental theorem of integral calculus.

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 or convergence of series - Series of non-negative terms - P- test - Cauchy's nth root test -D'- Alembert's 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 ANDMEANVALUETHEORMS

The derivability of a function at a point and 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 RIEMANNINTEGRATIN

Riemann Integral - Riemann integral functions - Darboux theorem - Necessary and sufficientcondition for R integrability - Properties of integrable functions - Fundamental theorem of integral calculus-Mean valueTheorems.

Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /ProblemSolving 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

SEM	Course Title	Course Code	Credits	Hrs/Wk
II B.Sc. Major (IV Sem)	**Integral Transforms with Applications**	**MAT23403**	**5**	**6**

CO 1. Understand the application of Laplacetransforms to solve ODEs.
CO 2. Understand the application of Laplacetransforms to solve Simultaneous Des.
CO 3. Understand the application of Laplacetransforms to Integral equations.
CO4. Basic knowledge of Fourier-Transformations.
CO 5. Comprehend the properties of Fourier transforms and solve problems related tofinite Fourier transforms.

Unit – I

Application of Laplace Transform to solutions of Differential Equations

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constantscoefficients - 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 DifferentialEquations.

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

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 ring theory concepts to Real life Problem /ProblemSolving Sessions.

Text book

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

Reference books

1. Fourier Series and Integral Transformations by Dr.S. Sreenadh and others, published by S.Chandand Co, New Delhi

2. E.M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton UniversityPress,2003).

3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003)

SEM	Course Title	Course Code	Credits	Hrs/Wk
V	LINEAR ALGEBRA	MAT23501& M-MAT23501	4	5

Course Outcomes:

After successful completion of this course, the student will be able to; 1.Understand the concepts of vector spaces, subspaces, bases, dimension and their properties

2.Understand the concepts of linear transformations and their properties

3.Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix andhigher powers of matrices without using routine methods

4.Learn the properties of inner product spaces and determine orthogonality in innerproduct spaces.

LINEAR ALGEBRA

UNIT – I Vector Spaces-I:

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebraof subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

UNIT –II Basis and dimension

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimensionof a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

UNIT –III Linear Transformations

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Range and nullspace of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

UNIT –IV : Eigen Values , Eigen vectors and Cay Hamilton theorem

Linear Equations, Characteristic equations, Characteristic Values & Vectors of square matrix,Cayley – Hamilton Theorem.

UNIT –V : Inner product space

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, Gram– Schmidtorthogonalisation process. Bessel's inequality and Parseval's Identity

Co-Curricular Activities

Seminar/ Quiz/ Assignments/ Linear algebra and its applications / Problem Solving.

Text Book:

Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir,Meerut-250002.

Reference Books:

1. Matrices by Shanti Narayana, published by S.Chand Publications.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (lowpriced edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4thEdition, 2007

4.Ccelms.ap.gov.in/

SEM	Course Title	Course Code	Credits	Hrs/Wk
V	Vector calculus	MAT23502 & M-MAT23502	4	5

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

1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral / three variables in the case of triple integral.
2. Learn applications in terms of finding surface area by double integral and volume by triple integral.
3. Determine the gradient, divergence and curl of a vector and vector identities.
4. Evaluate line, surface and volume integrals.
5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem

Unit – 1: Multiple integrals-I

Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals. 2. Region of integration, double integration in Polar Co-ordinates, 3. Change ofvariables in double integrals, change of order of integration.

Unit – 2: Multiple integrals-II

Triple integral, region of integration, change of variables. 2. Plane areas by double integrals, surface area by double integral. 3. Volume as a double integral, volume as a triple integral.

Unit – 3: Vector differentiation

Vector differentiation, ordinary derivatives of vectors. 2. Differentiability, Gradient,Divergence, Curl operators, 3. Formulae involving the operators.

Unit – 4: Vector integration

Line Integrals with examples. 2. Surface Integral with examples. 3. Volume integral withexamples.

Unit – 5: Vector integral Theorems

Gauss theorem and applications of Gauss theorem. 2. Green's theorem in plane and applications of Green's theorem. 3. Stokes's theorem and applications of Stokes theorem.

Reference Books:

1. Dr.M Anitha, Linear Algebra and Vector Calculus for Engineer, Spectrum University Press, SRNagar, Hyderabad-500038, INDIA.

2.Dr.M.Babu Prasad, Dr.K.Krishna Rao, D.Srinivasulu, Y.AdiNarayana, Engineering Mathematics-II, Spectrum University Press, SR Nagar, Hyderabad-500038,INDIA.

3. V.Venkateswararao, N. Krishnamurthy, B.V.S.S.Sarma and S.Anjaneya Sastry, A text Book ofB.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., Ram Nagar,NewDelhi-110055.

4. R.Gupta,Vector Calculus, Laxmi Publications.

5. P.C.Matthews, Vector Calculus, Springer Verlag publications.

6. Web resources suggested by the teacher and college librarian including reading material.

SEM	Course Title	Course Code	Credits	Hrs/Wk
V	ADVANCE NUMERICAL METHODS	MAT23503	4	5

After successful completion of this course, the student will be able to 5 hrs/week

Course Outcomes

1. find derivatives using various difference formulae
2. understand the process of Numerical Integration
3. solve Simultaneous Linear systems of Equations
4. understand Iterative methods
5. find Numerical Solution of Ordinary Differential Equations

Course Content

UNIT-I

Numerical Differentiation

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

UNIT-II

Numerical Integration

General quadrature formula on errors - Trapezoidal rule - Simpson's 1/3 rule Simpson's 3/8 rule- Boole's Rule(No question is to be set from this portion)

Weddle's rule - Euler-Maclaurin formula of summation and quadrature -The Euler transformation.

UNIT-III

Solution of Simultaneous Linear systems of Equations - I

Gauss Jordan Method. Solution of linear systems Direct Methods Matrix inversion method Gaussian elimination method-

UNIT-IV

Solution of Simultaneous Linear systems of Equations – II

Method of factorization - solution of Tridiagonal systems Iterative methods Jacobi's method Gauss Siedal method.

UNIT-V

Numerical Solution of Ordinary Differential Equations

Introduction - solution of Taylor's series - Picard's method of successive approximations – Euler's method-Modified Euler's method-Runge-Kutta methods.

Additional Inputs :

Boole's Rule

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 Publications.
2. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S.R. K. Iyengar and R. K. Jain, New Age International Publishers.

SEM	Course Title	Course Code	Credits	Hrs/Wk
V	Number theory	MAT23504	4	5

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

1. Find quotients and remainders from integer division, study divisibility properties of integers andthe distribution of primes.
2. Understand Dirichlet multiplication which helps to clarify interrelationship between variousarithmetical functions.
3. Comprehend the behaviour of some arithmetical functions for large n.
4. Understand the concepts of congruencies, residue classes and complete residues systems.
5. Comprehend the concept of quadratic residues $mod\ p$ and quadratic non residues $mod\ p$.

Unit – 1: Divisibility

1. Introduction, Divisibility, Greatest Common Divisor. 2. Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes. 3. The Euclidean algorithm, The greatest common divisor of more than two numbers.

Unit – 2: Arithmetical Functions and Dirichlet Multiplication

1. Introduction, The Mobius function $\mu(n)$, The Euler totient function $\varphi(n)$, A relation connecting $\varphi\ and\ \mu$, A product formula for $\varphi(n)$. 2. The Dirichlet product of arithmetical functions, Dirichlet inverses and Mobius inversion formula, The Mangoldt function $\mathrm{V}(n)$. 3. Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function $\lambda(n)$, The divisor functions

$\sigma_\alpha(n)$.

Unit – 3: Averages of Arithmetical Functions

1. Introduction, The big oh notation. Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas. 2. The average order of $d(n)$, The averageorder of the divisor functions $\sigma_\alpha(n)$., The average order of $\varphi(n)$. 3. The average order of

$\mu(n)$ and $\mathrm{V}(n)$, The partial sum of a Dirichlet product, Applications of $\mu(n)\ and$ $\mathrm{V}(n)$.

Unit – 4: Congruences

1. Definition and basic properties of congruences, Residue classes and complete residue systems. 2. Linear congruences, reduced residue systems and the Euler-Fermat theorem. Polynomial congruences modulo p. Lagrange's theorem. 3. Applications of Lagrange's theorem, Simultaneous linear

congruences. The Chinese remainder theorem. Applicationsof the Chinese remainder theorem.

Unit – 5: Quadratic Residues and the Quadratic Reciprocity Law

1. Quadratic Residues, Legendre's symbol and its properties, Evaluation of $(-1/p)$ and $(2/p)$, Gauss lemma, 2. The Quadratic reciprocity law, Applications of the reciprocity law, The Jacobi Symbol. 3. Gauss sums and the quadratic reciprocity law, the reciprocity law for quadratic Gauss sums. Another proof of the quadratic reciprocity law.

Reference Books:

1. Tom M.Apostol, Introduction to Analytic Number theory, Springer International Student Edition.
2. David, M. Burton, Elementary Number Theory, 2nd Edition UBS Publishers.
3. Hardy & Wright, Number Theory, Oxford Univ, Press.
4. Dence, J. B & Dence T.P, Elements of the Theory of Numbers, Academic Press.
5. Niven , Zuckerman &Montgomery, Introduction to the Theory of Numbers.
6. Web resources suggested by the teacher and college librarian including reading material.