ANDHRA KESARI UNIVERSITY:: ONGOLE

Model Syllabus for Mathematics (Minor) in consonance with Curriculum framework w.e.f. AY 2025-26

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of ~~Hrs~~ /Week credits	No. of ~~Credits~~ Hour/week
II	III	1	Differential Equations	4	5
	IV	2	Group Theory	4	5
III	V	3	Ring Theory	4	5
		4	Elementary Real Analysis	4	5
	VI	5	Linear Algebra	4	5
		6	Advanced Real Analysis	4	5

1.

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SEMESTER-V

COURSE 3: RING THEORY

Theory	Credits: 4	5 hrs/week

Course Objectives

The course aims to:

1. Introduce the fundamental concepts and properties of rings, fields, and integral domains.
2. Explain the structure and significance of subrings and ideals, including prime and maximal ideals.
3. Construct quotient rings and develop composition tables for finite rings.
4. Explore ring homomorphisms, isomorphisms, and apply the fundamental theorems of ring homomorphisms.
5. Study polynomial rings, including operations, division algorithm, irreducibility, and ideal structures.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Understand and differentiate between rings, integral domains, and fields, and describe their algebraic properties.
2. Identify and construct subrings and various types of ideals, and determine when a ring qualifies as a field.
3. Analyze quotient rings, build composition tables for finite rings, and distinguish between prime and maximal ideals.
4. Apply ring homomorphisms and isomorphisms effectively, and interpret the fundamental homomorphism theorems.
5. Solve problems involving polynomial rings over fields, including division algorithms, factorization, and irreducibility criteria.

Course Content

Unit – 1

Definition of a Ring and Examples –Basic properties – Commutative ring - Boolean ring – Zero Divisors of a ring - Cancellation Laws – Integral Domain – Division ring – Field - Idempotent and nilpotent elements in a ring and integral domain.

Unit – 2

The Characteristic of a Ring - The characteristics of integral domain, filed, Boolean ring - Definition and examples of Subrings – Necessary and sufficient condition for a nonempty subset to be a subring – Algebra of Subrings – Centre of a ring – Ideals – Algebra of ideals – A commutative ring with unity and without proper ideals is a filed.

	ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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1. Dr. D KALYANI
2. (CHERIYA)
3. K. S
4.

SEMESTER-III

COURSE 1: DIFFERENTIAL EQUATIONS

Theory **Credits: 4** **5 hrs/week**

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) $\frac{1}{Mx+Ny}$ (ii) $\frac{1}{Mx-Ny}$ - 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 $Q(x) = b\,x^k$, $Q(x) = e^{ax}\,V$, 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

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SEMESTER-IV

COURSE 2: GROUP THEORY

Theory	Credits: 4	5 hrs/week

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

Unit – 1

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

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 - 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

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

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

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