M. G. Science Institute (Autonomous) B. Sc. (Hons.) Mathematics

Semester-VI

DSC-C-MAT-361T: Analysis-II

Semester-VI	Course Title: Analysis-II	Credit: 4
Course Code: 361T	Major-2(T)	Hours: 4/week

Cos with Cognitive Abilities

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Recall definitions, standard results, and fundamental concepts related to Riemann integration, convergence of sequences and series, and power series.
CO2	UNDERSTANDING	Explain the concepts of Riemann integrability, improper integrals, convergence and divergence of series, and the meaning of absolute and conditional convergence.
CO3	APPLYING	Apply appropriate tests to determine convergence of sequences and series, evaluate Riemann and improper integrals, and obtain expansions of elementary functions using power series.
CO4	ANALYZING	Analyze the behavior of sequences, series, and power series using limit superior, limit inferior, and convergence criteria, and distinguish between different types of convergence.
CO5	EVALUATING	Assess the validity of convergence tests, integrability conditions, and series expansions, and justify conclusions using rigorous mathematical reasoning.
CO6	CREATING	Construct power series representations, Taylor and Maclaurin expansions, and develop approximations or simple differential equation solutions using series methods.

Unit	Detailed Syllabus	No. of Hours of Teaching
Unit-I	**Riemann Integration** Definition of Riemann integral. Riemann sums, integrability, and properties. Fundamental Theorems of Calculus. Mean value theorems for integrals. Improper integrals (first and second kind).	**15**
Unit-II	**Convergence of series** Limit superior and limit inferior of a sequence. Convergence of series. Tests for convergence of the series with positive terms.	**15**
Unit-III	**Tests for convergence** Absolute and conditional convergence. Tests: Comparison, Ratio, Root, Integral, Cauchy condensation, Abel–Dirichlet. Power series and its convergence.	**15**
Unit-IV	**Power Series & Expansions** Radius and interval of convergence of power series. Algebra of power series. Expansion of elementary functions. Maclaurin and Taylor series. Applications to approximation and simple differential equations.	**15**

Text Books:

1. G. Das & S. Pattanayak – *Fundamentals of Mathematical Analysis*.
2. D. Somasundaram & B. Choudhary – *A First Course in Mathematical Analysis*.
3. Ajit Kumar & S. Kumaresan – *A Basic Course in Real Analysis* (for differentiation & integration).

Reference Books

- R.G. Bartle & D.R. Sherbert – *Introduction to Real Analysis*.
- W. Rudin – *Principles of Mathematical Analysis*.
- T.M. Apostol – *Mathematical Analysis*.

M. G. Science Institute (Autonomous) B. Sc. (Hons.) Mathematics

Semester-VI

DSC-C-MAT-362T: Abstract Algebra

Semester-VI	Course Title: Abstract Algebra	Credit: 4
Course Code: 362T	Major-1(T)	Hours: 4/week

Cos with Cognitive Abilities

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Recall the fundamental definitions and properties of relations, groups, rings, fields, subgroups, and ideals.
CO2	UNDERSTANDING	Explain the basic concepts of algebraic structures and interpret theorems such as Lagrange's, Euler's, and Fermat's in context.
CO3	APPLYING	Apply the properties of groups, rings, and fields to solve algebraic problems
CO4	ANALYZING	Examine subgroup, coset, and ideal structures and distinguish between different algebraic systems.
CO5	EVALUATING	Test algebraic properties using relevant theorems and validate structures.
CO6	CREATING	Construct new examples of groups, rings, subrings, quotient rings, and demonstrate homomorphisms and isomorphisms.

Unit	Detailed Syllabus	No. of Hours of Teaching
Unit-I	**Relation, Binary operations & Groups** Relation, Equivalence Relation, Partition of set, Binary operations. Division Algorithm for Integers, Congruence modulo Relation in Z, Definition and Examples of Groups, Elementary properties of Group, Equivalent Definitions of a Group, Finite Groups and their tables, Commutative and non-commutative groups.	**15**
Unit-II	**Subgroups & Lattice diagrams** Subgroups: Definition and Examples, normalizer and centralizers, order of an element, order of a group, cyclic subgroup generated by an element, Lattice diagrams of finite groups, cosets and its properties, Lagrange's theorem and its applications, Euler's theorem, Fermat's theorem.	**15**
Unit-III	**Rings** Definition and examples, commutative ring, division ring, unity and unit elements of a ring, Field, properties of a ring, Boolean ring, Finite rings. Integral Domain: Zero divisor, Definition and examples of Integral Domain (Finite and of infinite order), Characteristic of a ring.	**15**
Unit-IV	**Subrings** Definition and examples, necessary and sufficient criterion for subring, Ideals: Definition and examples, necessary and sufficient criterion for ideal, principal ideal ring, quotient ring and its operation tables. Homomorphism: Definition and some examples, Kernel of homomorphism, Isomorphism of rings, Fundamental theorem on homomorphism, homomorphism and characteristic.	**15**

Text Book

1) Abstract Algebra - I. H. Sheth, PHI, New Delhi, Second edition-2009.

Reference Books

1) Topics in Algebra - I. N. Herstein, Vikas Publishing, New Delhi.

2) A First Course in Abstract Algebra - J. B. Fraleigh, Narosa Publishing, New Delhi.

3) Basic Abstract Algebra - P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Foundation Books, New Delhi.

4) Abstract Algebra - Dipak Chatterajee, PHI Learning Pvt. Ltd, New

MAM 363P: Mathematics Major Practical

Semester: VI	Course Title: Mathematics Major Practical	Credit: 4
Course No.: 363 P	Major (P)	Hours: 8/week

COs with Cognitive Abilities

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Recall and define the basic concepts of rings, commutative rings, rings with unity, and finite rings; construct their operation tables and verify ring axioms.
CO2	UNDERSTANDING	Explain and interpret the structures of ideals, integral domains, quotient rings, finite and extension fields, and distinguish between maximal and prime ideals.
CO3	APPLYING	Apply the Euclidean algorithm to find the GCD of two polynomials; test irreducibility and perform factorization; determine rational zeros over various fields.
CO4	ANALYSING	Analyze graph connectivity using adjacency matrices and fusion algorithms; determine shortest paths, minimum spanning trees, and Euler tours using Kruskal's, Prim's, Dijkstra's, Breadth-First, Backtracking, and Fleury's algorithms.
CO5	EVALUATING	Evaluate and test the properties of metric spaces, compactness, and connectedness; assess uniform convergence of sequences and series using appropriate theorems and convergence tests.
CO6	CREATING	Develop and construct new quotient rings, operation tables, and examples of finite fields and extension fields; design algorithms and proofs involving uniform convergence and power series.

Sr. No.	Title of the Practical	No. of Hours of Teaching
1.	Verification of Rings, Commutative ring and ring with unity. Finite rings and their operation tables.	5
2.	Examples of Ideals and Integral Domain.	5
3.	Examples of finite fields and extension fields.	5
4.	Construction of quotient ring and their operation tables.	5
5.	Find the g.c.d. of two given polynomials and express it as a linear combination of these two polynomials.	5
6.	Check the irreducibility of polynomial over the given field (By different methods.	5
7.	Factorization of polynomial and the rational zeros of given polynomial.	5
8.	Example of Maximal and prime ideal.	5

9.	Using the adjacency matrix, determine whether the given graph is connected or not.	5
10.	Determine whether the given graph is connected or not using fusion algorithm.	5
11.	Find a minimal spanning tree of a given connected weighted graph using Kruskal's algorithm.	5
12.	Find a minimal spanning tree of a given connected weighted graph using Prim's algorithm.	5
14.	Find a shortest path between two vertices of a given connected graph using the Breadth First.	5
15.	Find a shortest path between two vertices of a given connected graph using the Back-tracking.	5
16.	Find a shortest path between two vertices of a given connected weighted graph using the Dijk.	5
17.	Construct an Euler tour in a Euler graph using Fleury's algorithm.	5
18.	Metric spaces, examples.	5
19.	Uniform convergence of sequences.	5
20.	Uniform convergence of series, tem by term differentiation and integration.	5
21.	Multiplication of power series.	5
22.	Properties of exponential, logarithmic and trigonometric functions.	5
23.	Problems on compact and connected spaces.	5
24.	Absolute convergence, root and ratio tests using limit inferior and superior.	5