



Bharatiya Vidya
Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE

SAINIKPURI, SECUNDERABAD

Affiliated to Osmania University-Autonomous College

Reaccredited with 'A' grade by NAAC

B.Sc. MATHEMATICS I YEAR

Programme Name - B Sc (MECs, MPCs, MSCs)

SEMESTER-I

(60Hrs)

(w.e.f 2026-27)

Course Name: Differential Equations

Course Code: MT121

HPW: 4L + 1T

Credits: 5

Course Objectives: The objectives of the course are

- 1.To understand the fundamental concepts of first-order differential equations, including definitions, order, degree and standard forms.
2. To develop the ability to solve first-order differential equations but not of first degree.
- 3.To apply standard techniques to solve higher-order linear differential equations with constant coefficients.
- 4.To understand and determine complementary functions and particular integrals in solving differential equations.
5. To apply operator methods to obtain particular integrals of non-homogeneous linear differential equations with constant coefficients.
- 6.To analyze and solve higher-order linear differential equations with constant coefficients using systematic analytical techniques.
- 7.To analyze and evaluate solutions of higher-order linear differential equations with variable coefficients and simultaneous differential equations.
- 8.To formulate and solve mathematical models using total and simultaneous differential equations arising in scientific and engineering contexts.

Unit- I Differential Equations of First Order and First Degree (15Hrs)

Introduction, Equations in which Variables are Separable, Homogeneous Differential Equations, Differential Equations Reducible to Homogeneous Form, Linear Differential Equations, Differential Equations Reducible to Linear Form, Exact differential equations, Integrating Factors, Change in variables

(Chapters:2[2.1 to 2.9])

Unit- II Differential Equations First Order but not of First Degree (15Hrs)

Equations Solvable for p, Equations Solvable for y, Equations Solvable for x, Equations that do not contain x (or y), Equations Homogeneous in x and y, Equations of the First Degree in x and y, Clairaut's equation. Applications of First Order Differential Equations: Growth and Decay, Dynamics of Tumor Growth, Radioactivity and Carbon Dating, Compound Interest, Orthogonal Trajectories,

(Chapters:3[3.1&3.2]; 4[4.1 to 4.4 & 4.20])

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Unit- III Higher order Linear Differential Equation-I (15Hrs)

IKS Topic: Roots of quadratic auxiliary equations in IKS method (No questions to be set from this portion) Solution of homogeneous linear differential equations with constant coefficients, Solution of non-homogeneous differential equations $P(D)y = Q(x)$ with constant coefficients by means of polynomial operators when $Q(x) = be^{ax}$, $b\sin ax$, $b\cos ax$, x^k , $x^k e^{ax}$, $x^k \sin ax$, $x^k \cos ax$, Method of undetermined coefficients.
(Chapters: 5[5.1 to 5.4])

Unit- IV Higher order Linear Differential Equation-II ,Total and Simultaneous Differential Equations (15 Hrs)

Method of variation of parameters, Linear differential equations with non- constant coefficients The Cauchy-Euler Equation, Legendre's Linear Equations, Miscellaneous Differential Equations, Total Differential Equations, Simultaneous Total Differential Equations, Equations of the form $dx/P = dy/Q = dz/R$.
(Chapters: 5[5.5 to 5.9]; 2[2.10 to 2.12])

Prescribed Text Book:

"*Differential Equations and Their Applications*", Zafar Ahsan, Prentice Hall of India Learning Pvt .Ltd, 2- Edition, 2016.

"*Lilavati Of Bhaskaracarya*", Krishnaji Shankara Patwardhan, Somashekhara Amrita Naimpally, Shyam Lal Singh, Motilal Banarsidass Publishers, First edition 2021.
(For IKS Topic)

Reference Books:

1. Frank Ayres Jr, Theory and Problems of Differential Equations.
2. Ford, L.R ; Differential Equations.
3. Daniel Murray, Differential Equations.
4. S. Bala Chandra Rao, Differential Equations with Applications and Programs.
5. Stuart P Hastings, J Bryce McLead; Classical Methods in Ordinary Differential Equations.

Course Outcomes:

Students will be able to:

MT121 CO1: Define, classify, and identify first-order differential equations and recognize their standard forms.

MT121 CO2: Solve first-order differential equations but not of first degree.

MT121 CO3: Apply appropriate methods to solve higher-order linear differential equations with constant coefficients.


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MT121 CO4: Determine complementary functions and particular integrals for solving linear differential equations.

MT121 CO5: Compute particular integrals for equations of the form $P(D)y=Q(x)$, where $Q(x)$ includes exponential, trigonometric, and polynomial functions.

MT121 CO6: Determine complementary functions and construct general solutions of homogeneous and non-homogeneous differential equations using operator methods and the method of undetermined coefficients.

MT121 CO7: Solve and critically examine solutions of differential equations using methods such as variation of parameters, Cauchy–Euler equations, and simultaneous systems, and assess their mathematical consistency and behavior.

MT121 CO8: Construct and solve models represented by total differential equations and interpret the solutions in applied contexts.

CO-PO Mapping:

Course Outcomes \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
MT121 CO1	3	2	1	1	2	2	1	1	1	2
MT121 CO2	3	3	1	1	2	1	1	1	1	2
MT121 CO3	3	3	1	2	2	1	1	2	1	2
MT121 CO4	3	3	1	2	2	1	1	2	1	2
MT121 CO5	3	3	1	3	2	1	0	1	0	2
MT121 CO6	3	3	1	2	2	1	1	2	1	2
MT121 CO7	3	3	1	2	3	1	1	2	1	2
MT121 CO8	3	3	2	2	2	2	2	3	1	3
Mean/Average	3	2.9	1.1	1.9	2.1	1.3	1	1.8	.8	2.1

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B.Sc. MATHEMATICS II YEAR

Programme Name - B Sc (MECs, MPCs, MSCs)

SEMESTER-II (60 Hrs)

(w.e.f 2026-27)

Course Name: Real Analysis

Course Code: MT221

HPW: 4L+ 1T

Credits: 5

Course Objectives: This Objective of the course is

1. To understand definitions and fundamental concepts of sequences, including limit points, convergence, divergence, and Cauchy's general principle of convergence.
2. To apply algebra of sequences and theorems to analyze monotone sequences and convergence behavior.
3. To understand convergence of infinite series using standard tests for positive and alternating series.
4. To analyze limits and continuity of functions, including functions defined on closed intervals.
5. To apply differentiation techniques to study the behavior of functions, including monotonicity and higher-order derivatives.
6. To analyze and apply Rolle's, Lagrange's, and Cauchy's Mean Value Theorems in function analysis.
7. To understand the definition, properties, and conditions of Riemann integrability using partitions
8. To apply the concept of integration as a limit of sums and use the Fundamental Theorem of Calculus.

Unit- I Real Sequence (17 Hrs)

Real Numbers: Field Structure and Order Structure, Bounded and Unbounded Sets, Completeness in the set of Real Numbers, Absolute Value of a Real Number. (No questions to be set from this portion) **Open sets, Closed Sets and Countable Sets:** Limit points of a set, Closed Sets, Countable and Uncountable Sets. (No questions to be set from this portion)

Real Sequences: Sequences: Limit points of a sequence, Convergent Sequences, Non-Convergent Sequences (Definitions), Cauchy's General Principle of Convergence, Algebra of Sequences, Some important Theorems, Monotone Sequences

(Chapter 1: Sec 2 to 5, Chapter 2: Sec 2 to 4, Chapter 3: Sec 1, 2, 4, 5, 6, 7, 8, 9 (no proofs in Sec 7, 8, 9 (except Theorems-22, 29)))


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Unit- II Infinite Series & Functions of a Single Variable(I) (15 Hrs)

Infinite Series: Introduction, Positive Term Series, Comparison Tests for Positive Term Series, Cauchy's Root Test, D'Alembert's Ratio Test, Integral Test, Alternating Series (Leibnitz Test), Absolute Convergence. **Functions of a Single Variable (I):** Limits, Continuous Functions, Functions Continuous on Closed Intervals (Chapter 4: Sec 2,3,4,5 (No proofs from Sec 2), 8,10.1 & 10.2, Chapter 5: Sec 1,2,3 (No proofs from Sec 1 & 2))

Unit- III Functions of a single Variable (II)(13 Hrs)

Functions of a single Variable (II): The Derivative, Increasing and Decreasing Functions, Rolle's Theorem, Lagrange's Mean value Theorem, Cauchy's Mean value Theorem, Higher Order Derivatives (Chapter 6: Sec 1,3,5,6,7,8)

Unit- IV Riemann Integral (15 Hrs)

The Riemann Integral: Definition and Existence of the Integral, Refinement of Partitions, Darboux's Theorem, Conditions of Integrability, Integrability of the sum and difference of Integrable Functions (No Proofs of the theorems), The Integral as a limit of sums, some Integrable Functions, Integration and Differentiation (The Primitive)- Definition, The Fundamental Theorem of Calculus. (Chapter 9: Sec 1,2,3,4,5 (No Proofs), 6(6.1), 7,9)

Prescribed Text Book:

"Mathematical Analysis", S C Malik and Savita Arora, New Age International Publishers, Seventh Edition,

Reference Books

1. Elementary Analysis -The theory of Calculus, Kenneth A Ross, Springer, Second edition
2. Introduction to Real Analysis, William F Trench, William F Trench,
3. Introduction to Real Analysis I, Lee Larson, University of Louisville 2014
4. Mathematical Analysis, Santi Narayan and Mittal, S Chand, 29th Revised edition
5. Elementary Real Analysis, Brian S Thomson, Judith B Bruckner, Andrew M Bruckner

Course Outcomes:

MT221 CO1: Explain and apply the fundamental properties of real numbers, sets, and completeness in $\mathbb{R}$ using logical reasoning and appropriate mathematical communication.

MT221 CO2: Analyze and evaluate sequences for convergence using limit concepts and Cauchy's criterion with problem-solving and computational approaches.

MT221 CO3: Apply theorems on monotone sequences and collaborate to determine convergence behavior in mathematical and applied contexts.


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MT221 CO4: Test, compare, and interpret the convergence of infinite series using standard tests in real-life and scientific applications.

MT221 CO5: Evaluate limits and examine continuity of functions on intervals.

MT221 CO6: Apply derivatives and mean value theorems to analyze function behavior in scientific, environmental and practical problems.

MT221 CO7: Compute higher-order derivatives and interpret their significance using appropriate techniques and professional presentation.

MT221 CO8: Evaluate definite integrals using the Riemann integral and apply the Fundamental Theorem of Calculus in applied, interdisciplinary, and problem-solving contexts.

CO-PO Mapping:

Course Outcomes \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
MT221 CO1	3	2	1	1	2	2	2	1	1	2
MT221 CO2	3	3	1	2	2	1	2	2	1	2
MT221 CO3	3	3	1	1	2	1	2	2	3	2
MT221 CO4	3	3	2	2	2	1	2	3	1	2
MT221 CO5	3	3	1	3	2	1	0	0	0	2
MT221 CO6	3	3	2	2	2	2	2	3	1	2
MT221 CO7	3	2	1	2	3	1	2	2	1	2
MT221 CO8	3	3	2	2	2	2	2	3	1	3
Mean/Average	3	2.7	1.3	1.8	2.1	1.3	1.7	2	1.1	2.1


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