Calculus: Day-wise Lesson Plan

Teacher: Krishan Sharma

Course: B.Sc. I Sem (As per NEP 2020) Subject: Calculus

Duration: 45 Days (Theory) + 30 Days (Practical)

Theory Plan (45 Days)

Day	Topic
Day 1	Course introduction, syllabus, assessment pattern. Intro to limits — intuitive idea and examples.
Day 2	Basic properties of limits and limit laws. Practice problems.
Day 3	ε-δ definition of limit — formal definition and worked examples.
Day 4	Continuity: definitions, examples, and continuous functions.
Day 5	Types of discontinuities (removable, jump, infinite) and examples.
Day 6	Differentiability: definition, geometric meaning, and examples.
Day 7	Rules of differentiation (product, quotient, chain) with practice.
Day 8	L'Hospital's rule — statement, proof sketch, and applications.
Day 9	Successive differentiation — higher derivatives and examples.
Day 10	Leibniz theorem for nth derivative of a product — statement and problems.
Day 11	Taylor series — concept, expansion for standard functions, radius of convergence.
Day 12	Maclaurin series, remainder forms and examples.
Day 13	Unit I Test (short written problems + problem solving).
Day 14	Test feedback, common mistakes, and remedial practice (Unit I).
Day 15	Unit II — Introduction to asymptotes; horizontal & vertical asymptotes (algebraic curves).
Day 16	Oblique asymptotes and methods to find them (algebraic curves).
Day 17	Asymptotes for polar curves and examples.
Day 18	Intersection of a curve and its asymptotes; worked problems.
Day 19	Curvature: geometric idea; curvature and radius of curvature (Cartesian form).
Day 20	Curvature in parametric and polar forms; examples and computation techniques.

Day 21	Newton's method — derivation, convergence discussion and examples.
Day 22	Centre of curvature and circle of curvature — definitions and examples.
Day 23	Problem solving session: asymptotes & curvature combined problems.
Day 24	Unit II Test (written + applications problems).
Day 25	Test feedback & remedial practice (Unit II).
Day 26	Unit III — Multiple points: definitions, identification and simple examples.
Day 27	Classification of multiple points: node, cusp, conjugate point, with examples.
Day 28	Tests for concavity and convexity; second derivative test and examples.
Day 29	Points of inflection — identification and worked problems.
Day 30	Tracing curves — Cartesian coordinate methods (step-by-step procedure).
Day 31	Tracing curves — Parametric form (method + examples).
Day 32	Tracing curves — Polar form (method + examples).
Day 33	Reduction formulae — introduction and derivation for common integrals.
Day 34	Reduction formulae — problems and recursive techniques.
Day 35	Curve tracing & reduction formulae intensive problem-solving session.
Day 36	Unit III Test (written + curve tracing problems).
Day 37	Test feedback & remedial practice (Unit III).
Day 38	Unit IV — Rectification and arc length for Cartesian curves (derivation + examples).
Day 39	Arc length for parametric and polar curves; sample problems.
Day 40	Intrinsic equation of a curve and quadrature — concepts and examples.
Day 41	Area bounded by closed curves — methods and examples.
Day 42	Volumes of solids of revolution — disk/washer and shell methods (Cartesian).
Day 43	Surfaces of revolution — surface area formulae and examples (parametric & polar).
Day 44	Mixed problem-solving session (Units III & IV) — integrated problems and revision.
Day 45	Final Theory Test (comprehensive; covers Units I–IV).

Practical Plan (30 Days)

Practical Day	Topic
Day 1	Introduction to MAXIMA — interface, basic operators and functions.
Day 2	Simplify algebraic expressions and expressions with radicals/logs/trig using MAXIMA.
Day 3	Expand algebraic, rational, trigonometric and logarithmic expressions in MAXIMA.
Day 4	Compute derivatives (algebraic, trig, exponential, log) with MAXIMA.
Day 5	Derivatives of composed functions and chain-rule examples in MAXIMA.
Day 6	Successive differentiation problems and verification with MAXIMA.
Day 7	Indefinite integrals of various functions using MAXIMA.
Day 8	Definite integrals and numerical evaluation in MAXIMA.
Day 9	Plotting Cartesian curves using MAXIMA.
Day 10	Plotting parametric curves using MAXIMA.
Day 11	Plotting polar curves using MAXIMA.
Day 12	Demonstration of singular points (node, cusp) using MAXIMA.
Day 13	Curve tracing (Cartesian) using MAXIMA.
Day 14	Curve tracing (Parametric) using MAXIMA.
Day 15	Curve tracing (Polar) using MAXIMA.
Day 16	Compute radius of curvature (Cartesian/parametric/polar) using MAXIMA.
Day 17	Compute length of curves (arc length) using MAXIMA.
Day 18	Volumes & surfaces of revolution using MAXIMA.
Day 19	Manual problem-solving session: successive differentiation & reduction formulae.
Day 20	Manual problem-solving session: volumes & surface area.
Day 21	Mid-practical exam — execute MAXIMA program + solve problem by hand.
Day 22	Viva-voce and submission of practical record (midterm submission).
Day 23	Advanced plotting/visualization in MAXIMA.
Day 24	Group mini-project: trace a complex curve.
Day 25	Lab assignment: compile MAXIMA program portfolio.

Day 26	Debugging session: common MAXIMA errors and fixes.
Day 27	Mock practical exam — run-through under exam conditions.
Day 28	Practical revision, doubt clearing and record completion.
Day 29	Final practical exam (program + write-up + viva).
Day 30	Final feedback, grades submission and wrap-up.

Lesson Plan 2025-26

Name of the Assistant Professor: **Ms. Manisha**

Class and Section: **B.Sc. 3rd Semester (NEP)**

Subject: **Mathematics (Differential Equations)**

Week	Date	Topics
1	1 Aug- 9Aug	Introduction to differential equations, solution of differential equations of first order and first degree. Exercise 1.1,1.2,1.3,1.4.
2	11 Aug- 16 Aug	Exact DEs, Solution of exact DEs, Integrating factors, exercise 2.1 to 2.4
3	18 Aug – 23 Aug	Exercise 2.5 to 2.7. Solution of equation of first order but not of first degree. Exercise 3.1, 3.2.
4	25 Aug – 30 Aug	Exercise 3.3, Lagrange equation, Clairaut's equation, Exc. 3.4, equation reducible to Clairaut's eqn. exc. 3.5.
5	1 Sept – 6 Sept	Singular solution, Exc. 3.6. Introduction to orthogonal trajectories, problems & exercise 4.1.
6	8 Sept – 13 Sept	Introduction to Linear DE with constant coefficient, Solution of homogeneous and non-homogeneous DE, exc. 5.1, 5.2, 5.3.
7	15 Sept – 20 Sept	Exercise 5.4 to 5.6, Cauchy-Euler equation, exc. 6.1. Linear DE of second order with variable coeff, exercise 7.1. CLASS TEST
8	22 Sept – 27 Sept	Solution of DE of second order by method of variation of parameters, exercise 7.2, solving linear DE of second order by method of undetermined coeff., exercise 7.3.
9	29 Sept – 4 Oct	Solution of Ordinary Simultaneous DE, exc. 8.1, 8.2, second integral found with the help of first, exc. 8.3.
10	6 Oct – 11 Oct	Introduction to total differential equations, necessary and sufficient condition for integrability of total DE, exercise 9.1, 9.2.
11	13 Oct – 18 Oct	Exercise 9.3, 9.4, Introduction to Partial DEs.
12	27 Oct- 1 Nov	Solution of first order linear Partial DEs, exc. 10.1.

13	03 Nov- 08 Nov	Integral surfaces passing through a curve, Exc. 10.2, surfaces orthogonal to given system of surfaces, Exc. 10.3. Introduction to first order non-linear PDE, Exc. 11.1.
14	10 Nov- 15 Nov	Charpit's method, Jacobi's method, Exc. 11.2 to 11.4.
15	17 Nov- 22 Nov	Second order Linear PDE with const. coeff, solution of homogeneous, non-homogeneous PDE, exc. 12.1, 12.2.
16	24 Nov- 29 Nov	Problem Discussion, Revision
17	1 Dec onwards	EXAMINATIONS

Practical

Practical Day	Topic
1	Introduction to MAXIMA — interface, basic operators and functions.
2	Problems solving for differential equations which are reducible to homogeneous.
3	Problems solving for differential equations which are Exact differential equations.
4	Problems solving for linear differential equations with constant coefficient.
5	Problems solving for linear differential equations with variable coefficient.
6	Problems solving for differential equations by method of variation of parameters.
7	Problems solving for differential equations by method of undetermined coefficients.
8	Problems solving for simultaneous differential equations.
9	Problems solving for different PDEs using Lagrange's method.
10	Problems solving for PDEs with Charpit's method and Jacobi's method.
11	Solutions of first and second order differential equations in MAXIMA.
12	Plotting of family of solutions of differential equations of first, second and third order using MAXIMA.
13	Solution of differential equations using method of variation of parameters using MAXIMA.
14	Growth and decay model (exponential case only).
15	Lake pollution model (with constant/seasonal flow and pollution concentration).
16	Density-dependent growth model.
17	Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two prey one predator).
18	To find the solutions Linear differential equations of second order using built in functions of MAXIMA software.
19	To find numerical solution of a first order ODE using plotdf built in function of MAXIMA.
20	To find exact solutions of first and second order ODEs using ode2 and ic1/ic2 built in functions of MAXIMA.
21	To find exact solutions of first and second order ODEs using desolve and atvalue built in functions of MAXIMA.

Teacher Name: **Krishan Sharma**
Course: B.Sc. V Sem

Real Analysis (Paper: 12BSM 351)

Unit I: The Riemann Integral

Day	Topic
Day 1	Course introduction, syllabus overview, and assessment pattern.
Day 2–4	Partitions of an interval, upper and lower Riemann sums, and related properties.
Day 5–7	Definition of the Riemann integral, necessary and sufficient conditions for integrability.
Day 8–10	Integrability of continuous functions and monotonic functions with proofs and examples.
Day 11–13	The Fundamental Theorem of Integral Calculus: First and second forms, with proofs and applications.
Day 14–16	Mean Value Theorems of Integral Calculus: First and second Mean Value Theorems with examples.
Day 17–19	Intensive problem-solving session covering all topics in Unit I.
Day 20	Revision for Unit I Test.
Day 21	**Unit I Test** (Covering Riemann integrals, the Fundamental Theorem, and Mean Value Theorems).
Day 22	Test feedback, discussion of common errors, and remedial practice for Unit I.

Unit II: Improper Integrals & Integrals as a Function of a Parameter

Day	Topic
Day 23–25	Introduction to improper integrals (Type 1 and Type 2) and their convergence with examples.
Day 26–28	Comparison tests for convergence of improper integrals (direct, limit, and μ-test).
Day 29–31	Advanced convergence tests: Abel's test and Dirichlet's test with worked examples.
Day 32–34	Frullani's integral: Statement, proof, and application problems.
Day 35–37	Integral as a function of a parameter: Concept and examples.
Day 38–40	Continuity, differentiability, and integrability of an integral of a function of a parameter.
Day 41–42	Intensive problem-solving session covering all topics in Unit II.
Day 43	Revision for Unit II Test.
Day 44	**Unit II Test** (Covering improper integrals, convergence tests, and integrals as a function of a parameter).

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Day	Topic
Day 45	Test feedback and remedial practice for Unit II.

Unit III: Metric Spaces I

Day	Topic
Day 46–48	Definition and examples of metric spaces; pseudo-metrics and equivalent metrics.
Day 49–51	Neighborhoods, limit points, interior points, and their properties.
Day 52–54	Open sets, closed sets, closure, interior, and boundary of a set.
Day 55–57	Subspace of a metric space with examples.
Day 58–60	Cauchy sequences and the concept of completeness in metric spaces.
Day 61–63	Cantor's intersection theorem and Baire's category theorem with proofs.
Day 64–65	The Contraction Principle (Banach fixed-point theorem) and its applications.
Day 66	Problem-solving session and revision for Unit III.
Day 67	**Unit III Test** (Covering basic metric space topology, sequences, and completeness).
Day 68	Test feedback and remedial practice for Unit III.

Unit IV: Metric Spaces II

Day	Topic
Day 69–71	Continuous functions in metric spaces: Definitions (ε-δ and sequential) and examples.
Day 72–74	Uniform continuity: Definition, examples, and relationship with continuity.
Day 75–77	Compactness for metric spaces: Definitions, sequential compactness, and the Bolzano-Weierstrass property.
Day 78–80	Total boundedness and the finite intersection property.
Day 81–83	Continuity in relation to compactness.
Day 84–86	Connectedness: Definitions, components, and continuity in relation to connectedness.
Day 87–88	Mixed problem-solving session (Units III & IV) and comprehensive revision.
Day 89	Final revision and doubt-clearing session.
Day 90	**Final Theory Test** (Comprehensive; covers Units I-IV).

Groups and Rings Lesson Plan (Paper: 12BSM 352)

Unit I: Introduction to Groups

Day	Topic
Day 1	Course introduction, syllabus overview, and assessment pattern.
Day 2–4	Definition of a group, abelian groups, finite and infinite groups, and simple properties.
Day 5–7	Subgroups: Definition, examples, and subgroup criteria.
Day 8–10	Generation of groups and the concept of cyclic groups, with properties and theorems.
Day 11–13	Cosets: Left and right cosets, their properties, and index of a subgroup.
Day 14–16	Coset decomposition and Lagrange's theorem with its consequences.
Day 17–19	Normal subgroups: Definition, criteria, and examples.
Day 20	Quotient groups: Definition, construction, and related theorems.
Day 21	**Unit I Test** (Covering groups, subgroups, cyclic groups, cosets, and normal subgroups).
Day 22	Test feedback, discussion of common errors, and remedial practice for Unit I.

Unit II: Homomorphisms and Permutation Groups

Day	Topic
Day 23–26	Homomorphisms of groups: Definition, examples, kernel, and image.
Day 27–29	Isomorphisms, automorphisms, and inner automorphisms of a group.
Day 30–32	Automorphisms of cyclic groups with proofs and examples.
Day 33–35	Permutation groups: Symmetric groups, cycles, and transpositions.
Day 36–38	Even and odd permutations and the alternating group (A_n).
Day 39–41	Cayley's theorem: Statement, proof, and significance.
Day 42	Center of a group and the derived group of a group.
Day 43	Problem-solving session and revision for Unit II.
Day 44	**Unit II Test** (Covering homomorphisms, automorphisms, and permutation groups).
Day 45	Test feedback and remedial practice for Unit II.

Unit III: Introduction to Rings

Day	Topic
Day 46–49	Introduction to rings: Definition, types (commutative, with unity), and examples.
Day 50–52	Subrings: Definition, criteria, and examples.
Day 53–56	Integral domains and fields: Definitions, properties, and examples.

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Day	Topic
Day 57–59	Characteristics of a ring with examples.
Day 60–62	Ring homomorphisms: Definition, properties, kernel, and image.
Day 63–65	Ideals: Definition, types (principal, prime, maximal), and their properties.
Day 66	Quotient rings and the field of quotients of an integral domain.
Day 67	**Unit III Test** (Covering rings, integral domains, fields, ideals, and homomorphisms).
Day 68	Test feedback and remedial practice for Unit III.

Unit IV: Special Rings and Polynomials

Day	Topic
Day	**Topic**
Day 69–72	Euclidean rings (Euclidean domains): Definition, properties, and examples (Z, F[x]).
Day 73–76	Introduction to polynomial rings and their basic properties.
Day 77–79	Polynomials over the rational field and the Eisenstein's criterion for irreducibility.
Day 80–82	Polynomial rings over commutative rings.
Day 83–86	Unique Factorization Domain (UFD): Definition and properties.
Day 87	Theorem: If R is a UFD, then R$[x_1, x_2, \ldots, x_n]$ is also a UFD.
Day 88	Mixed problem-solving session and comprehensive revision for all units.
Day 89	Final revision and doubt-clearing session.
Day 90	**Final Theory Test** (Comprehensive; covers Units I-IV).

Lesson Plan 2025-26

Name of the Assistant Professor: **Ms. Manisha**

Class and Section: **B.Sc. 5th Semester**

Subject: **Mathematics (Numerical Analysis)**

Week	Date	Topics
1	1 Aug- 9Aug	Introduction to finite difference operators, forward difference, backward difference, fundamental theorem of difference calculus, properties of operators, difference of some functions.
2	11 Aug- 16 Aug	Displacement or shift operators and its properties, relation between various operators, exercise 1.1, error in tabular value, exercise 1.2.
3	18 Aug – 23 Aug	Introduction to interpolation, Newton's formula for forward interpolation, Newton backward interpolation formula, exercise 2.1, subdivision of intervals, exercise 2.2
4	25 Aug – 30 Aug	Newton's divided difference formula, exercise 3.1, lagrange's interpolation formula, Hermite's interpolation formula, exercise 3.2.
5	1 Sept – 6 Sept	Gauss forward interpolation formula, Gauss backward interpolation formula, Sterling formula, Bessel's formula, exercise 4.1.
6	8 Sept – 13 Sept	Introduction to probability distribution, random variable, mean and variance of a random variable, binomial distribution, Recurrence formula, fitting a binomial distribution, exercise 5.1, 5.2.
7	15 Sept – 20 Sept	Poisson distribution, normal distribution, exercise 5.3, 5.4, Introduction to numerical differentiation.
8	22 Sept – 27 Sept	Numerical distribution using Newton forward, Newton backward, Sterling formula, exercise 6.1.
9	29 Sept – 4 Oct	Eigen values, eigen vectors, Power method, Jacobi's method for symmetric matrix, Tridiagonal matrix.

10	6 Oct – 11 Oct	Given's method, House holder method, exercise 7.1, QR method, Lancoz's method.
11	13 Oct – 18 Oct	Numerical integration, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, error in quadrature formulae.
12	27 Oct- 1 Nov	Gauss's quadrature formula, exercise 8.1. Introduction to numerical solution of ODE, Single step and multiple step method, Euler's method, Euler's modified method, exercise 9.1, Taylor's series method, RK Method.
13	03 Nov- 08 Nov	Picard's Method, exercise 9.2, predictor corrector method: Milne- Simpson's Method, Adam-Bashforth method, exercise 9.3.
14	10 Nov- 15 Nov	Program of Newton forward, Newton backward interpolation formula, Lagrange's interpolation.
15	17 Nov- 22 Nov	Program of Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Euler's Method, Euler's Modified method.
16	24 Nov- 29 Nov	Problem Discussion, Revision
17	1 Dec onwards	EXAMINATIONS